





John Carter Brown  
Library  
Brown University

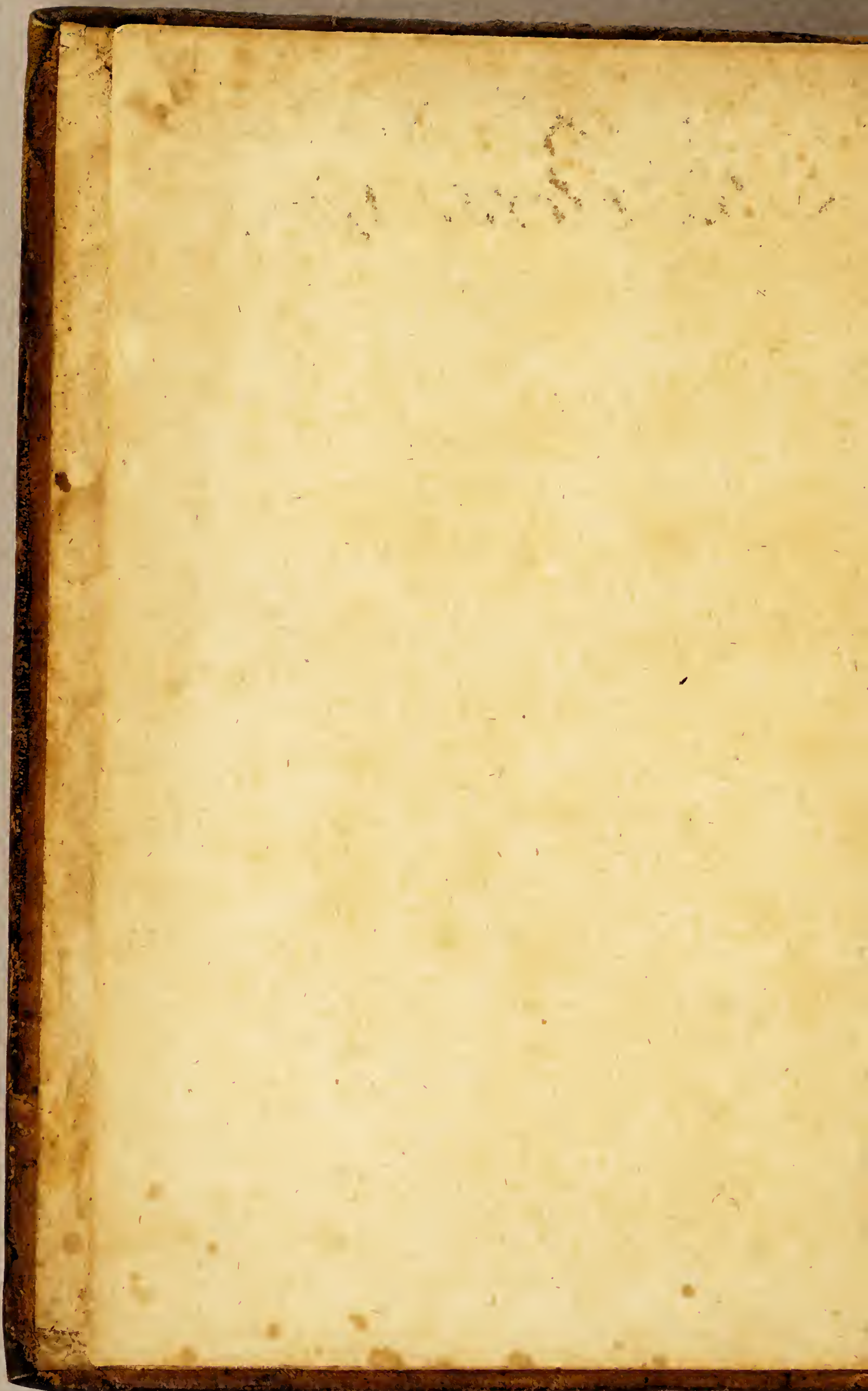
*The Gift of*  
Wallis Darnley



271  
A. Peters. 1768

---

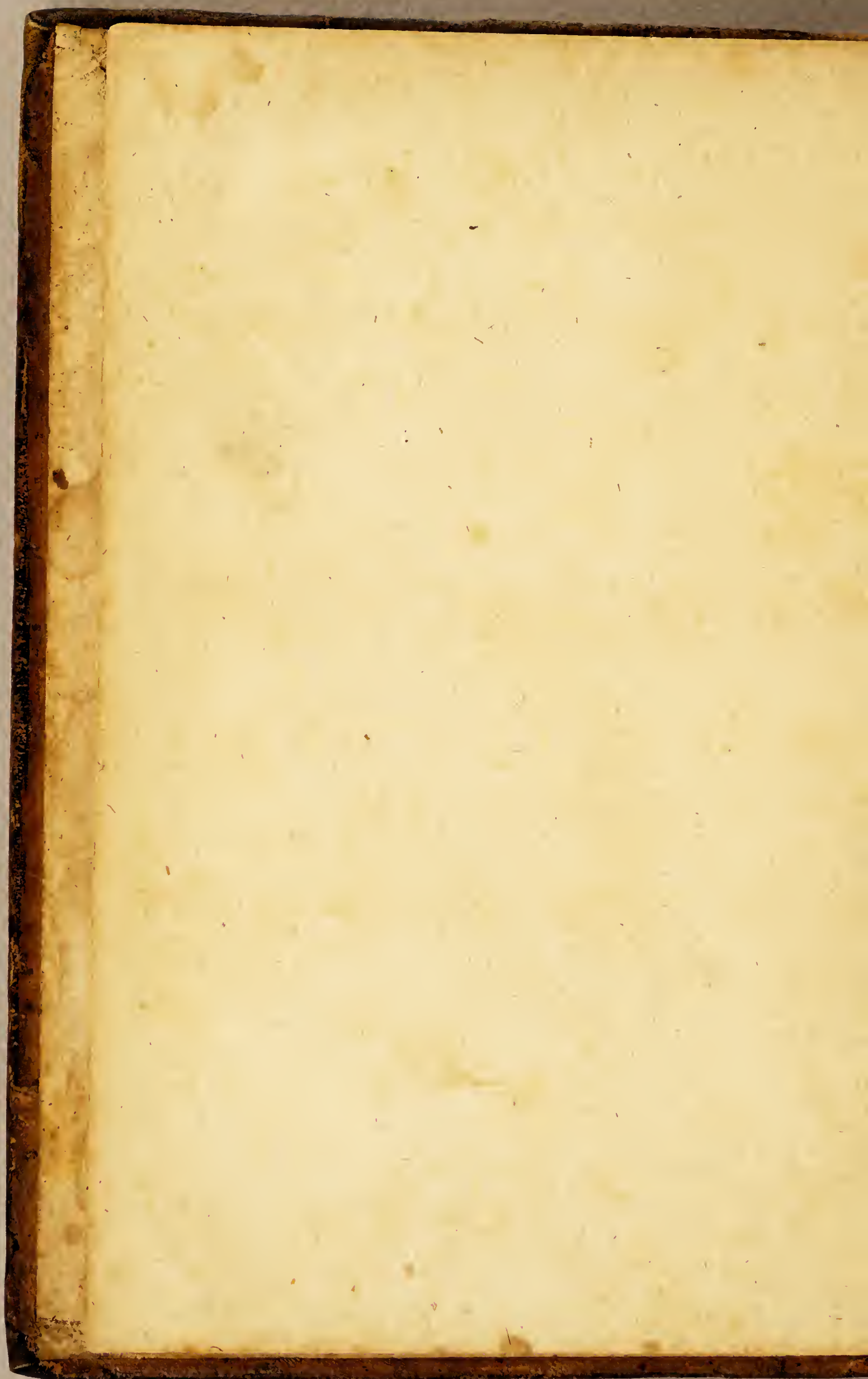












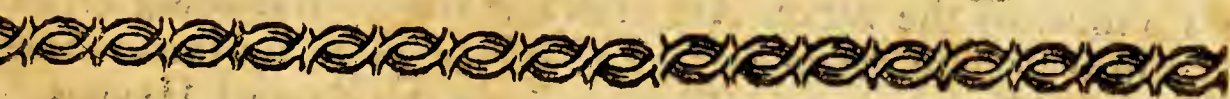




T H E

# Mariner's Compass

R E C T I F I E D.





BOOKS of Navigation, Sea Charts, &c. Printed for  
W. and J. MOUNT, T. PAGE & SON, on *Tower-hill*.

- G**REAT Britain's Coasting Pilot, by Capt. Greenville Collins.  
Coasting Pilot for England, Scotland and Holland.  
English Pilot for the Channel.  
English Pilot for the Straits.  
English Pilot for West India.  
English Pilot for Guinea.  
English Pilot for East India.  
Sea-Atlas, containing Charts of the Sea-Coasts of the whole World.  
A compleat Set of New Charts, containing North Sea, Cattegat, Balti  
A compleat Set of Charts for the Sea-Coast of France.  
A Set of Charts for India, and others for all parts of the World.  
The Mariner's New Calendar, by Nathaniel Colson.  
The Seaman's Vademecum, or Defensive War by Sea, by William  
Mountaine, F.R.S.  
The Seaman's Practice, by Richard Norwood.  
Practical Navigation, or an Introduction to the Whole Art, by J. Seller  
Navigatio Britannica, or a compleat System of Navigation, in all  
Branches, both with regard to Theory and Practice, by J. Barrow.  
Sherwin's Tables of Logarithms from 1 to 101000.  
Elements of Algebra, expounded in Two Books, by John Kersey.  
The Seaman's Daily Assistant, by T. Havelden.  
Navigation New Modelled, by Henry Wilson.  
Navigation Unveil'd, 2 vols Octavo, by Edward Hanxley.  
Mariner's Compass Rectified, by Andrew Wakeley.  
The Practical Sea Gunner's Companion, by W. Mountaine, F.R.S.  
An Epitomy of the Whole Art of Navigation, containing an easy m  
thodical Way to become a compleat Navigator, by James Atkinson  
Treatise of Trigonometry, Third Edition, by Samuel Heynes.  
Epitomy of Navigation, being the most useful Part of Gellibrand  
Norwood's and Jones's Works, collated and digested into c  
Compendium of Navigation.  
Ship Builder's Assistant, or Marine Architecture, by W. Sutherland  
Euclid's Elements, the whole Fifteen Books, by Isaac Barrow.  
The Modern Navigator's compleat Tutor, in 2 Volumes, by Josh. Kel  
The Sector and Plane Scale compared, by Roger Rea.  
Description and Use of 4 several Quadrants, by J. Collins, with  
Prints from Copper.  
Use of Coggeshall's Sliding Rule, and Description of Scamozzi's Li  
A Mercator's Chart, shewing the Variation of the Compass, in all  
known Seas, by W. Mountaine, F.R.S.  
N.B. There are also Sold all sorts of Mathematical Instruments a  
Books, Sea Charts for all Parts of the known World, Plane a  
Mercator; Paper, Paper-Books, and other Stationary Wares.



T H E

# Mariner's Compass

## RECTIFIED;

Containing TABLES, shewing the true Hour of the Day, the Sun being upon any Point of the Compass: With the true Time of the *Rising* and *Setting* of the *Sun* and *Stars*, and the Points of the *Compass* upon which they *Rise* and *Set*: With Tables of *Amplitudes*. Which Tables of Sun - Dials, Semidiurnal-Arches and Amplitudes are calculated from the *Equator* to 60 Degrees of Latitude, either North or South.

With the Description and Use of those Instruments most in Use in the Art of NAVIGATION.

Also a TABLE of the LATITUDES and LONGITUDES of Places.

---

By ANDREW WAKELEY, *Mathematician*.

---

Enlarged with many useful Additions, by *J. Atkinson*.

---

The Whole revised, and carefully corrected, with accurate Tables of the *Sun's Declination*, adjusted to the *New-Style*.

By WILLIAM MOUNTAINE, F.R.S.

---

L O N D O N:

Printed for W. and J. MOUNT, and T. PAGE, on *Tower-Hill*, where you may have all Sorts of Sea Books, 1763.



# Missionary

## REPORT

During the year 1881, the mission of the American Board of Commissioners for Foreign Missions, in the Hawaiian Islands, has been successful in its efforts to spread the Gospel of Jesus Christ among the native population. The number of converts has increased, and the work of the missionaries has been sustained by the contributions of the people.

The following table shows the number of converts and the amount of contributions received during the year.

Year	Number of Converts	Amount of Contributions
1880	1,200	\$10,000
1881	1,500	\$12,000

The following table shows the number of converts and the amount of contributions received during the year.

Year	Number of Converts	Amount of Contributions
1882	1,800	\$15,000
1883	2,000	\$18,000





## To the R E A D E R.

Courteous R E A D E R,

*W*HEN I first entered upon these my Labours, and after I had begun the Calculations, I found that tho' the Book would be small, yet my Labour so great that I almost fainted. Yet at length, when I considered the ordinary, necessary, and frequent Use that might be made of these my Labours, I was thereby encouraged to go on and prosecute my Work; and how ready and easy I have made it for Practice, will plainly appear (by immediate Inspection) to the meanest Capacity.

Here follows a brief Explanation of the Method and Order of the Book: First, you will find Tables of the Sun's Declination, newly calculated from the best Hypothesis yet discovered, and applied to the Meridian of London, whose Latitude is 51d. 31m. North, and Longitude according to these Tables 00d. 00m. Next you will find Tables shewing the true Hour and Minute of the Day, the Sun being upon any Point of the Compass, which Tables are as Dials, fitting all Places in the World, whose Pole is elevated, not above 60d. either North or South: Likewise by these Tables you may know the true Hour and Minute of the Night, by the Bearing of any of the known Fixed Stars between the Tropics: Then you will find Tables shewing the true Time of the Sun's Rising and Setting, with the Length of the Day and Night: Also by these Tables you may find the true Time of Rising



*and Setting of all the eminent Fixed Stars between the Tropics. Next you will find Tables shewing the Points of the Compass that the Sun, and all the abovesaid Stars Rise and Set upon; which Tables are of excellent Use for readily finding the Variation of the Compass, and may be performed by a Meridian Compass that is about ten Inches in Diameter, whose Points are divided into Halves and Quarters; such a Compass I suppose to be convenient for a Mariner's Use, where he hath not an Azimuth Compass. Next you will find Tables of Amplitudes to every Degree of the Sun's Declination: All these Tables are calculated from the Equator to Sixty Degrees of Latitude, either North or South; and they will last with Exactness as long as G O D upholdeth the Order and Course of Nature.*

*In the Appendix you will find the Use of all those Instruments that are most in Use in the Art of NAVIGATION, either for Operation, or Observation; Likewise a Table containing the most and chiefest Harbours, Headlands, and Islands in the World; shewing the Latitude and Longitude at each of them; beginning the Longitude at the Meridian of London; the Whole disposed in a new successive Order.*

*This Method, I own, but how I have acquitted myself therein, I shall leave to the Judgment and Experiments of the most skilful Mariners that the World affords, which are my native Countrymen of England.*

And now fare ever well, so wishes he,  
Who is more yours, than he can seem to be.

ANDREW WAKELEY.



To the P U B L I C.

S I R S,

**B**EING desired by the Bookseller concerned herein, I willingly undertook the Examination of this Treatise, (and the rather for that Respect I bear to the Memory of my Master, the deceased Author) which for its Usefulness hath obtained good Esteem with our NAVIGATORS: I therefore have taken the greater Pains, and spent much Time in examining each Table, amending, altering, explaining, and enlarging where I saw Cause: Having endeavoured to render the Whole of the MARINER'S COMPASS RECTIFIED most familiar, and easy to an ordinary Capacity.

In this Edition I have contracted the *Table of Amplitudes in Points of the Compass*, and yet as intelligible as before, by which having made more Room, I have made the *Reader* amends with large Additions in the Use of each Table, and methodizing the Discourse throughout; but more especially in the *Use of Instruments*, I have taken Liberty to Repair, Alter, and Enlarge, that it will appear as good as new; but chiefly in the *Description and Use of the Gunter, Sliding Gunter, and Sector*; principally the two former; whose *Uses* I have shewed in *Arithmetic*, to *Multiply, Divide*, and work the *RULE OF THREE*; in *Geometry*, to work *Proportions, Continued, Duplicate, and Triplicate*;



*Mensuration of Superficies and Solids*; as to measure Board, Timber, Stone, Gauging of Vessels, Tunnaging of Ships, Bales or Boxes; also in Gunnery; in Navigation, both in Plane and Mercator's Sailing: In Astronomy, the most useful Problems, As to find the Sun's Place, Declination, Rising, Setting, Amplitude, Azimuth, Hour, and Altitude at all Times. And in all, you are directed plainly to perform them, both by Sliding Gunter, and with Compasses.

In the *Table of Latitudes and Longitudes*, I have added many Places of Note, and omitted some few that were of little Moment, and have corrected both the Latitudes and Longitudes of the most Eminent, according to the latest Observations: So that I am bold to say, it is the most exact Table of its Kind extant.

These, with many more *Additions*, through the Whole, I hope will find Acceptance with *Young Students in the Mathematics*, and prove serviceable to them, both in the *Study and Practice* of NAVIGATION, and other Parts of the MATHEMATICS: For whose Sakes I took the greater Pains herein.

JAMES ATKINSON.

EXACT





EXACT TABLES  
OF THE  
SUN'S DECLINATION,  
*Adapted to the Gregorian, or  
New - Stile.*

READER,

**B***Y* Observations made at distant Times, Astronomers have discovered that there is a Recession of the Equinoctial Points, which as it makes an Alteration in the Sun's Longitude, in Respect to the same Points of Time from Year to Year, so it consequently makes an annual (tho' small) Variation in the Declination: And as the Latitude at Sea depends so much on the Accuracy of those Tables, I have with great Exactness new calculated the same; the Tables also of Lat. and Long. at the End of this Book, I have compared with all the various Observations I could meet with, and have rectified (with the greatest Care) whatever I found repugnant to superior Authority.

WILLIAM MOUNTAINE,

Teacher of the Mathematicks, in Shad-Thames,  
Southwark. Young Gentlemen Boarded.



*First after Leap-Year.*

Sun's Declination 1761, 1765, 1769, 1773, 1777.

Days	Jan.		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D	M	D	M	D	M	D	M	D	M	D	M
1	22	59	16	57	07	24	04	44	15	14	22	09
2	22	54	16	40	07	01	05	07	15	32	22	17
3	22	48	16	22	06	38	05	31	15	50	22	24
4	22	42	16	04	06	14	05	54	16	07	22	31
5	22	35	15	56	05	51	06	17	16	24	22	38
6	22	27	15	27	05	28	06	39	16	41	22	44
7	22	19	15	08	05	05	07	02	16	58	22	50
8	22	11	14	49	04	41	07	24	17	14	22	55
9	22	03	14	30	04	18	07	46	17	30	23	00
10	21	54	14	11	03	54	08	08	17	45	23	05
11	21	45	13	52	03	30	08	30	18	01	23	09
12	21	35	13	32	03	06	08	52	18	16	23	13
13	21	25	13	12	02	42	09	14	18	31	23	17
14	21	15	12	51	02	19	09	35	18	45	23	20
15	21	05	12	30	01	55	09	57	19	00	23	22
16	20	54	12	09	01	32	10	18	19	14	23	24
17	20	42	11	48	01	08	10	39	19	27	23	26
18	20	29	11	27	00	44	11	00	19	40	23	27
19	20	16	11	05	00	21	11	21	19	53	23	28
20	20	02	10	43	Nor. 02		11	41	20	06	23	29
21	19	48	10	22	00	26	12	02	20	18	23	29
22	19	34	10	00	00	50	12	22	20	30	23	29
23	19	20	09	38	01	14	12	42	20	41	23	28
24	19	05	09	16	01	37	13	02	20	52	23	27
25	18	50	08	54	02	01	13	21	21	03	23	25
26	18	35	08	31	02	24	13	40	21	14	23	23
27	18	20	08	09	02	48	14	00	21	24	23	21
28	18	04	07	46	03	11	14	19	21	34	23	18
29	17	48			03	35	14	38	21	43	23	15
30	17	31			03	58	14	56	21	52	23	11
31	17	14			04	21			22	01		



*First after Leap-Year.*

Sun's Declination 1761, 1765, 1769, 1773, 1777.

Days	July		August		Sept.		Octob.		Nov.		Decem.	
	North		North		North		South		South		South	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	07	17	58	08	09	03	23	14	37	21	55
2	23	03	17	43	07	47	03	46	14	56	22	04
3	22	59	17	27	07	25	04	09	15	15	22	13
4	22	54	17	11	07	03	04	32	15	34	22	21
5	22	48	16	55	06	41	04	55	15	52	22	29
6	22	42	16	38	06	19	05	18	16	10	22	36
7	22	35	16	21	05	56	05	41	16	28	22	43
8	22	28	16	04	05	33	06	04	16	45	22	49
9	22	21	15	47	05	10	06	27	17	02	22	55
10	22	14	15	29	04	47	06	49	17	19	23	00
11	22	06	15	11	04	24	07	12	17	36	23	05
12	21	58	14	53	04	01	07	35	17	52	23	10
13	21	49	14	35	03	38	07	58	18	08	23	14
14	21	40	14	17	03	15	08	20	18	24	23	17
15	21	31	13	58	02	52	08	42	18	39	23	20
16	21	21	13	39	02	29	09	04	18	54	23	23
17	21	11	13	20	02	06	09	26	19	09	23	25
18	21	00	13	00	01	43	09	48	19	24	23	27
19	20	49	12	41	01	20	10	10	19	38	23	28
20	20	38	12	21	00	56	10	32	19	51	23	29
21	20	27	12	01	00	33	10	54	20	04	23	29
22	20	15	11	41	00	09	11	15	20	17	23	29
23	20	03	11	21	Sou. 14		11	36	20	30	23	28
24	19	50	11	00	00	38	11	57	20	42	23	27
25	19	37	10	39	01	01	12	18	20	54	23	25
26	19	24	10	18	01	25	12	38	21	05	23	23
27	19	10	09	57	01	48	12	59	21	16	23	20
28	18	56	09	36	02	12	13	29	21	26	23	17
29	18	42	09	15	02	36	13	39	21	36	23	14
30	18	28	08	53	03	00	13	58	21	46	23	10
31	18	13	08	31			14	17			23	06



*Second after Leap-Year.*

Sun's Declination 1762, 1766, 1770, 1774, 1778.

Days	Jan.		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D	M	D	M	D	M	D	M	D	M	D	M
1	23	02	17	01	07	28	04	39	15	09	22	06
2	22	56	16	44	07	05	05	02	15	27	22	14
3	22	50	16	26	06	42	05	25	15	45	22	22
4	22	43	16	08	06	19	05	48	16	03	22	29
5	22	36	15	50	05	56	06	11	16	20	22	36
6	22	29	15	32	05	33	06	33	16	37	22	42
7	22	21	15	13	05	10	06	56	16	53	22	48
8	22	13	14	54	04	46	07	18	17	09	22	54
9	22	05	14	35	04	23	07	41	17	25	22	59
10	21	56	14	15	03	59	08	03	17	41	23	04
11	21	47	13	56	03	36	08	25	17	57	23	08
12	21	37	13	36	03	12	08	47	18	12	23	12
13	21	27	13	16	02	49	09	09	18	27	23	15
14	21	16	12	55	02	25	09	30	18	42	23	18
15	21	05	12	34	02	01	09	52	18	56	23	21
16	20	54	12	13	01	37	10	13	19	10	23	23
17	20	42	11	52	01	14	10	34	19	24	23	25
18	20	30	11	31	00	50	10	55	19	37	23	27
19	20	18	11	10	00	26	11	16	19	50	23	28
20	20	05	10	49	00	02	11	37	20	03	23	29
21	19	51	10	27	Nor. 21		11	58	20	15	23	29
22	19	37	10	05	00	44	12	18	20	27	23	29
23	19	23	09	43	01	08	12	37	20	38	23	28
24	19	09	09	21	01	32	12	57	20	49	23	27
25	18	55	08	59	01	56	13	17	21	00	23	26
26	18	40	08	37	02	19	13	36	21	11	23	24
27	18	24	08	14	02	43	13	55	21	21	23	22
28	18	08	07	51	03	06	14	14	21	31	23	19
29	17	52			03	30	14	33	21	40	23	16
30	17	36			03	53	14	51	21	49	23	13
31	17	19			04	16			21	58		



*Second after Leap-Year.*

Sun's Declination 1762, 1766, 1770, 1774, 1778.

Days	July		August		Sept.		Octob.		Nov.		Decem.	
	North		North		North		South		South		South	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	09	18	01	08	14	03	16	14	32	21	53
2	23	04	17	46	07	52	03	39	14	51	22	02
3	22	59	17	30	07	30	04	03	15	10	22	11
4	22	54	17	14	07	08	04	26	15	29	22	19
5	22	49	16	58	06	46	04	49	15	47	22	27
6	22	43	16	42	06	24	05	12	16	05	22	34
7	22	37	16	25	06	01	05	35	16	23	22	41
8	22	30	16	08	05	38	05	58	16	41	22	47
9	22	23	15	51	05	16	06	21	16	58	22	53
10	22	16	15	33	04	53	06	44	17	15	22	59
11	22	08	15	16	04	30	07	07	17	32	23	04
12	22	00	14	58	04	07	07	30	17	48	23	09
13	21	51	14	40	03	44	07	53	18	04	23	13
14	21	42	14	21	03	21	08	15	18	20	23	16
15	21	33	14	02	02	58	08	37	18	35	23	19
16	21	23	13	43	02	35	08	59	18	50	23	22
17	21	13	13	24	02	11	09	21	19	05	23	24
18	21	03	13	05	01	47	09	43	19	20	23	26
19	20	52	12	45	01	24	10	05	19	34	23	27
20	20	41	12	25	01	01	10	27	19	48	23	28
21	20	29	12	05	00	38	10	48	20	01	23	29
22	20	17	11	45	00	14	11	09	20	14	23	29
23	20	05	11	25	Sou.	09	11	30	20	27	23	28
24	19	53	11	05	00	32	11	51	20	39	23	27
25	19	40	10	44	00	56	12	12	20	51	23	25
26	19	27	10	23	01	19	12	33	21	02	23	23
27	19	14	10	02	01	43	12	53	21	13	23	21
28	19	00	09	41	02	06	13	13	21	24	23	18
29	18	46	09	20	02	29	13	33	21	34	23	14
30	18	31	08	58	02	52	13	53	21	44	23	10
31	18	16	08	30			14	13			23	06



*Third after Year.*

Sun's Declination 1763, 1767, 1771, 1775, 1779.

Days	Jan.		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	02	17	05	07	34	04	33	15	05	22	04
2	22	57	16	48	07	11	04	56	15	23	22	12
3	22	51	16	31	06	48	05	19	15	41	22	20
4	22	45	16	13	06	25	05	42	15	59	22	28
5	22	38	15	55	06	02	06	05	16	16	22	35
6	22	31	15	36	05	39	06	28	16	33	22	41
7	22	23	15	18	05	16	06	51	16	50	22	47
8	22	15	14	59	04	52	07	13	17	06	22	53
9	22	07	14	40	04	29	07	35	17	22	22	58
10	21	59	14	20	04	05	07	57	17	38	23	03
11	21	30	14	00	03	42	08	20	17	54	23	07
12	21	40	13	40	03	18	08	42	18	09	23	11
13	21	30	13	20	02	55	09	04	18	24	23	14
14	21	19	13	00	02	31	09	25	18	38	23	17
15	21	08	12	40	02	07	09	47	18	53	23	20
16	20	57	12	19	01	43	10	08	19	07	23	23
17	20	45	11	58	01	20	10	29	19	20	23	25
18	20	33	11	37	00	56	10	50	19	33	23	27
19	20	20	11	16	00	33	11	11	19	46	23	28
20	20	07	10	54	00	09	11	31	19	59	23	29
21	19	54	10	32	Nor. 14		11	52	20	12	23	29
22	19	40	10	10	00	38	12	12	20	24	23	29
23	19	26	09	48	01	02	12	32	20	36	23	28
24	19	12	09	26	01	26	12	52	20	47	23	27
25	18	58	09	04	01	50	13	12	20	58	23	26
26	18	43	08	42	02	13	13	31	21	09	23	24
27	18	27	08	20	02	37	13	50	21	19	23	22
28	18	11	07	57	03	00	14	09	21	29	23	20
29	17	55			03	24	14	28	21	39	23	17
30	17	39			03	47	14	47	21	48	23	13
31	17	22			04	10			21	56		



*Third after Leap-Year.*

Sun's Declination 1763, 1767, 1771, 1775, 1779.

Days	July		August		Sept.		Octob.		Nov.		Decem.	
	North		North		North		South		South		South	
	D	M	D	M	D	M	D	M	D	M	D	M
1	23	09	18	05	08	20	03	10	14	27	21	51
2	23	05	17	50	07	58	03	34	14	47	22	00
3	23	01	17	34	07	36	03	57	15	06	22	09
4	22	56	17	18	07	13	04	20	15	25	22	17
5	22	51	17	02	06	51	04	44	15	43	22	25
6	22	45	16	46	06	29	05	07	16	01	22	32
7	22	39	16	29	06	07	05	30	16	19	22	39
8	22	32	16	12	05	44	05	53	16	37	22	46
9	22	25	15	55	05	22	06	16	16	54	22	52
10	22	18	15	38	04	59	06	39	17	11	22	58
11	22	10	15	20	04	36	07	02	17	28	23	03
12	22	02	15	02	04	13	07	25	17	44	23	08
13	21	53	14	44	03	50	07	48	18	00	23	12
14	21	44	14	26	03	27	08	10	18	16	23	16
15	21	35	14	07	03	04	08	32	18	32	23	19
16	21	26	13	48	02	40	08	54	18	47	23	22
17	21	16	13	29	02	17	09	16	19	02	23	24
18	21	05	13	10	01	53	09	38	19	16	23	26
19	20	54	12	50	01	30	10	00	19	30	23	28
20	20	43	12	30	01	07	10	22	19	44	23	29
21	20	32	12	10	00	44	10	43	19	58	23	29
22	20	20	11	51	00	20	11	04	20	11	23	29
23	20	08	11	30	Sou. 03		11	25	20	24	23	28
24	19	56	11	09	00	26	11	46	20	36	23	27
25	19	43	10	49	00	50	12	07	20	48	23	26
26	19	30	10	28	01	13	12	28	20	59	23	24
27	19	17	10	07	01	37	12	49	21	10	23	22
28	19	03	09	46	02	00	13	09	21	21	23	19
29	18	49	09	25	02	23	13	29	21	31	23	16
30	18	35	09	04	02	46	13	49	21	41	23	12
31	18	20	08	42			14	08			23	08



*Leap-Year.*

Sun's Declination 1764, 1768, 1772, 1776, 1780.

Days	Jan.		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	03	17	09	07	16	04	50	15	19	22	10
2	22	57	16	52	06	53	05	13	15	37	22	18
3	22	51	16	35	06	30	05	36	15	54	22	25
4	22	45	16	17	06	07	05	59	16	11	22	32
5	22	39	15	59	05	44	06	22	16	28	22	39
6	22	33	15	41	05	21	06	45	16	45	22	45
7	22	26	15	23	04	58	07	08	17	02	22	51
8	22	18	15	04	04	34	07	30	17	18	22	56
9	22	10	14	45	04	11	07	52	17	34	23	01
10	22	01	14	25	03	47	08	14	17	50	23	06
11	21	52	14	05	03	24	08	36	18	05	23	10
12	21	42	13	45	03	00	08	58	18	20	23	13
13	21	32	13	25	02	37	09	20	18	35	23	17
14	21	22	13	05	02	13	09	42	18	49	23	20
15	21	11	12	45	01	49	10	03	19	03	23	23
16	21	00	12	24	01	25	10	24	19	17	23	25
17	20	48	12	03	01	01	10	45	19	31	23	27
18	20	36	11	42	00	38	11	06	19	44	23	28
19	20	23	11	21	00	14	11	27	19	57	23	29
20	20	10	10	59	Nor.	09	11	47	20	09	23	29
21	19	57	10	38	00	33	12	07	20	21	23	29
22	19	44	10	16	00	56	12	27	20	33	23	29
23	19	30	09	54	01	20	12	47	20	44	23	28
24	19	16	09	31	01	44	13	07	20	55	23	27
25	19	01	09	09	02	08	13	27	21	06	23	25
26	18	46	08	47	02	31	13	46	21	16	23	23
27	18	31	08	25	02	54	14	05	21	26	23	20
28	18	15	08	02	03	17	14	24	21	36	23	17
29	17	59	07	39	03	41	14	43	21	45	23	14
30	17	43			04	04	15	01	21	54	23	11
31	17	26			04	27			22	02		



Leap-Year.

Sun's Declination 1764, 1768, 1772, 1776, 1780.

Days	July		August		Sept.		Octob.		Nov.		Decem.	
	North		North		North		South		South		South	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	07	17	53	08	03	03	28	14	42	21	58
2	23	02	17	38	07	41	03	52	15	01	22	07
3	22	57	17	22	07	19	04	15	15	20	22	15
4	22	52	17	06	06	57	04	38	15	39	22	23
5	22	46	16	50	06	35	05	01	15	57	22	31
6	22	40	16	33	06	12	05	24	16	15	22	38
7	22	34	16	16	05	50	05	47	16	33	22	45
8	22	27	15	59	05	27	06	10	16	50	22	51
9	22	20	15	42	05	04	06	33	17	07	22	56
10	22	12	15	24	04	41	06	56	17	24	23	01
11	22	04	15	06	04	18	07	19	17	40	23	06
12	21	55	14	48	03	55	07	42	17	56	23	10
13	21	46	14	30	03	32	08	04	18	12	23	14
14	21	37	14	11	03	09	08	26	18	28	23	18
15	21	28	13	53	02	46	08	48	18	43	23	21
16	21	18	13	34	02	23	09	10	18	58	23	23
17	21	08	13	15	02	00	09	32	19	13	23	25
18	20	57	12	55	01	36	09	54	19	27	23	27
19	20	46	12	36	01	13	10	16	19	41	23	28
20	20	35	12	16	00	49	10	38	19	54	23	29
21	20	24	11	56	00	26	10	59	20	07	23	29
22	20	12	11	35	00	02	11	20	20	20	23	29
23	19	59	11	15	Sou. 21		11	41	20	32	23	28
24	19	46	10	54	00	44	12	02	20	44	23	26
25	19	33	10	33	01	08	12	23	20	56	23	24
26	19	20	10	12	01	31	12	44	21	08	23	22
27	19	06	09	51	01	55	13	04	21	19	23	20
28	18	52	09	30	02	18	13	24	21	30	23	17
29	18	38	19	09	02	41	13	44	21	40	23	13
30	18	23	08	47	03	05	14	04	21	49	23	09
31	18	08	08	25			14	23			23	04



## A Description of the TABLES of the SUN'S DECLINATION.

**T**HESSE Tables are in general for Four Years; Leap-Year, First, Second and Third Year after Leap-Year, and consequently for any Year.

Each Year (taking up two Pages) hath the first Six Months of the Year on the Left-hand Page, and the last six Months are on the Right-hand Page, the Names of the Months are at the Head of each Column, and the Days of each Month in the Left-hand Column of each Page.

The first Table sheweth the Sun's Declination every Day for the first Years after Leap-Year, being 1761, 1765, 1769, 1773, 1777, &c. and takes up Pages (10 and 11:) The second Table is for 1762, 1766, 1770, 1774, 1778, &c. being Second Years after Leap-Year, in Pages (12) and (13): The next Table in Pages (14) and (15) is for the Third Years after Leap-Year: The Fourth Table in Pages (16) and (17) sheweth the Sun's Declination for Leap-Years, being 1764, 1768, 1772, 1776, 1780, &c.

Under the Name of the Month, is the Name of the Declination either North or South, only the Column for *March* and *September*, hath two Names; that is, under *March* is South, and against the 21st and 20th Day (according as it is Leap-Year, or 1st, 2d, 3d Year after) is *Nor.* for North; and under *September* is North, and against the 23d, or 24th Day is *Sou.* for South; intimating the Declination is South in *March*, till the 21st or 20th Day, and all the remaining Part of the Month it's *Nor.* or North; In like manner in *September*, it's North till the 23d or 24th Day, from thence to the Month's end it's *Sou.* or South.



*The Use of the Tables of Declination.*

**T**O find the Sun's Declination for any Day in any Year, is after this manner.

1. Seek the Year and Month, at the Head of the Table; and the Day of the Month in the Left-hand Column.

2. Then right under the Month, at the Head of the Table, and against the Day of the Month in the Left-hand Column, is the Sun's Declination required.

*Example 1.* I desire to know the Sun's Declination for the 24th Day of *April*, 1762.

The Year 1762, is the second Year after Leap-Year, which is in Page (12): then under *April*, and against 24 (under Days) is 12.57, with North at the Head of the Table under *April*; which sheweth the Sun's Declination on the 24th of *April*, 1762, is 12d. 57m. North.

*Example 2.* What is the Sun's Declination for the 21st of *March*, 1764.

The Year 1764 being Leap-Year, is found in Page 16; then against the 21st Day, and under *March*, is Nor. 0.33; signifying the Sun's Declination at that Time is 0od. 33m. North; the like do for any othe Time.



*A Table to Proportion the Sun's Declination to any other Meridian.*

East West { Long. with Dec.		Degrees of Longitude.	The Daily Difference in Declination.											
			m	m	m	m	m	m	m	m	m	m	m	m
			—	—	—	—	—	—	—	—	—	—	—	—
			2	4	6	8	10	12	14	16	18	20	22	24
			—	—	—	—	—	—	—	—	—	—	—	—
			m	m	m	m	m	m	m	m	m	m	m	m
		15	0	0	0	0	0	0	1	1	1	1	1	1
		30	0	0	0	1	1	1	1	1	1	2	2	2
		45	0	0	1	1	1	1	2	2	2	2	3	3
		60	0	1	1	1	2	2	2	3	3	3	4	4
		75	0	1	1	2	2	2	3	3	4	4	5	5
		90	0	1	1	2	2	3	3	4	4	5	5	6
		105	1	1	2	2	3	3	4	5	5	6	6	7
		120	1	1	2	3	3	4	5	5	6	7	7	8
		135	1	1	2	3	4	4	5	6	7	7	8	9
		150	1	2	2	3	4	5	6	7	7	8	9	10
		165	1	2	3	4	5	5	6	7	8	9	10	11
		180	1	2	3	4	5	6	7	8	9	10	11	12

*The Use of this TABLE of Proportion.*

THE Tables of the Sun's Declination are calculated for the Meridian of *London*, and will serve for any Place under that Meridian; but for those Places situate Easterly or Westerly from it, the Declination must be proportioned according to its daily Difference in the Table, and Longitude of those Places from the Meridian of *London*; for which Purpose this Table is used, as is evident by these Examples following.

*Example*



*Example 1.*

Admit the 10th Day of *April*, Anno 1764. I am in Longitude 105d. East; I demand what Declination the Sun will have that Day in the Meridian of that Place?

The Declination for *April* the 10th, in the Meridian of *London* is 08d. 14m. increasing, and the daily Difference at that Time, is 22m. therefore in this Table look in the Head thereof for the Number 22, or nearest thereunto, if not in the Table; then look on the Left-hand of the Table for 105d. (or the nearest thereto) the Longitude I am in, and in the common Angle of meeting is 6 min. which is to be deducted from the Declination in the Meridian of *London* aforesaid 8d. 14m. and the Remainder will be the Declination for that Meridian, or the Longitude I am in, which is 08d. 08m. North. But if the Declination had decreased, as it doth here increase, then you must have added, as hereunder you may see.

	d.	m.
The Declination in the Meridian of <i>London</i> is	08	: 14 N
The Proportional Minutes subtract - - - --	00	: 06

---

The Decl. for the Longitude of 105d. East is 08 : 08 N

---

The Decl. for the Longitude of 105d. West is 08 : 20 N

*Example 2.*

Admit the 10th Day of *October*, Anno 1766. I am in Longitude 87 deg. West: I demand what Declination the Sun will have that Day in that Meridian?

The daily Difference in the Table of Declination, at this Time is 23m. and the Proportional Part thereof by the last Table is 5 min. increasing.

	d.	m.
The Declination in the Meridian of <i>London</i> —	06	: 44 S
The Proportional Minutes add - - - - -	00	: 05

---

The Declination in the Long. of 87d. West is 06 : 49 S

---

The Declination for the Long. of 87d. East is 06 : 39 S



*A TABLE of Refraction deduced from Mr. Flamsteed's Observations, made at the Royal Observatory at Greenwich.*

Altitudes	Refractions	Altitudes	Refractions	Altitudes	Refractions	Altitudes	Refractions
D.	M.S.	D.	M. S.	D.	M.S.	D.	M.S.
00	23.00	10	4.33	25	1.45	40	0.58
00 $\frac{1}{2}$	26.38	11	4.06	26	1.40	41	0.56
01	23.22	12	3.45	27	1.36	42	0.54
02 $\frac{1}{2}$	20.17	13	3.29	28	1.31	43	0.52
02	17.26	14	3.13	29	1.27	44	0.50
02 $\frac{1}{2}$	15.15	15	3.00	30	1.23	45	0.48
03	13.23	16	2.48	31	1.20	46	0.46
03 $\frac{1}{2}$	11.53	17	2.38	32	1.17	47	0.45
04	10.39	18	2.29	33	1.14	48	0.44
04 $\frac{1}{2}$	9.38	19	2.21	34	1.11	49	0.42
05	8.48	20	2.14	35	1.09	50	0.40
06	7.26	21	2.07	36	1.07	55	0.34
07	6.25	22	2.01	37	1.05	60	0.29
08	5.37	23	1.55	38	1.02	70	0.19
09	5.02	24	1.50	39	1.00	80	0.09
10	4.33	25	1.45	40	0.58	90	0.00

The Refraction of the Sun, Moon and Stars, causeth them to appear higher above the Horizon than they are; therefore the Refraction is always to be subtracted from the Altitude observed, that the true Altitude may be had.

As, admit the Sun's Meridian Altitude, by Observation, to be 5 Degrees; I demand the true Altitude?

	d.	m.
Altitude by Observation being	- - -	05 : 00
Sun's Refraction 8m. 48s. subtract	- -	00 : 09
The Sun's true Meridian Altitude is	- -	04 : 51

*Primum*



---

*PRIMUM MOBILE:*

O R,

Astronomic Tables;

Each T A B L E being

A S U N - D I A L,

S H E W I N G

The Exact Hour of the Day, the Sun being upon any Point of the Compass; fitting all Places upon the Earth and Sea, that lie between the Equator and 60 Degrees of Latitude, either North or South: And to last with Exactness as long as the Omnipotent and Everlasting Creator shall be pleased to conserve the Great and Wonderful Fabric of Nature.



NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
North	12	12	12	12	12	12	12	12	12	12	12
n by w		0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.17	0.19	0.20
n n w		0.04	0.08	0.12	0.17	0.21	0.25	0.30	0.35	0.39	0.41
nw by n		0.07	0.13	0.20	0.27	0.34	0.41	0.49	0.56	1.03	1.07
n w		0.10	0.20	0.30	0.41	0.51	1.02	1.14	1.25	1.35	1.43
nw byw		0.15	0.30	0.45	1.01	1.18	1.35	1.53	2.12	2.29	2.42
w n w		0.24	0.49	1.14	1.41	2.09	2.41	3.18	4.06	5.11	
w by n		0.51	1.44	2.46	4.10						
West											
☉ fet	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0.00	2.30	5.00	7.30	10.0	12.30	15.0	17.30	20.0	22.0	23.29

SOUTH DECLINATION.

[illegible]



NORTH DECLINATION.

SOUTH DECLINATION.

[illegible]



## A Sun-Dial for the Latitude of 2 Degrees.

## NORTH DECLINATION.

0 d	Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12	North	12	12	12	12	12	12	12	12	12	12
0.02	n by w	Zen. West.	0.02	0.04	0.06	0.09	0.11	0.13	0.15	0.17	0.18
0.03	n n w		0.05	0.09	0.13	0.18	0.22	0.27	0.32	0.35	0.38
0.05	nw by n		0.08	0.15	0.22	0.29	0.36	0.44	0.51	0.57	1.02
0.08	n w		0.12	0.22	0.33	0.43	0.54	1.05	1.17	1.27	1.34
0.12	nw byw		0.18	0.33	0.49	1.05	1.22	1.40	2.00	2.16	2.29
0.20	w n w		0.29	0.53	1.21	1.50	2.21	2.58	3.45	4.46	
0.40	w by n		1.03	2.03	3.23						
6.00	West										
6.00	☉ set	6.00	6.00	6.00	6.01	6.02	6.02	6.02	6.03	6.03	6.04
d m	Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
0.00	Ampl.	2.30	5.00	7.30	10.0	12.30	15.0	17.31	20.1	22.1	23.30

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22
s s w	0.03	0.07	0.12	0.16	0.20	0.25	0.29	0.34	0.38	0.42	0.45
sw by s	0.05	0.12	0.19	0.25	0.32	0.39	0.46	0.54	1.01	1.08	1.12
s w	0.08	0.18	0.28	0.38	0.48	0.59	1.10	1.21	1.33	1.42	1.50
sw byw	0.12	0.27	0.42	0.57	1.13	1.29	1.46	2.04	2.23	2.40	2.53
w s w	0.20	0.43	1.08	1.33	2.00	2.28	3.00	3.36	4.24	5.24	
w by s	0.40	1.30	2.22	3.22	4.43						
West	6.00										
☉ set	6.00	6.00	6.00	5.59	5.59	5.58	5.58	5.58	5.57	5.57	5.56



A Sun-Dial for the Latitude of 3 Degrees.

NORTH DECLINATION.

0 d	Deg. Min.	2 d 30m	5 d 30m	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12	North	12	12	12	12	12	12	12	12	12	12
0.02	n by w	Zen. West.	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.17
0.05	n n w		0.03	0.07	0.12	0.16	0.20	0.25	0.29	0.33	0.36
0.08	nw by n		0.05	0.12	0.19	0.26	0.33	0.40	0.48	0.54	0.9
0.12	n w		0.08	0.18	0.29	0.39	0.50	1.01	1.13	1.23	1.31
0.18	nw byw		0.12	0.27	0.43	0.59	1.16	1.34	1.54	2.10	2.24
0.29	w n w		0.20	0.45	1.11	1.39	2.11	2.47	3.33	4.33	
0.59	w by n		0.42	1.40	2.57						
6.00	West										
6.00	☉ fet	6.00	6.00	6.01	6.02	6.02	6.03	6.04	6.04	6.05	6.05
d m	Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
0.00	Ampl.	2.30	5.00	7.30	10.1	12.31	15.1	17.31	20.2	22.2	23.32

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d 30m	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.02	0.05	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.22
s s w	0.05	0.09	0.13	0.18	0.22	0.26	0.31	0.35	0.40	0.44	0.47
sw by s	0.08	0.15	0.21	0.28	0.35	0.42	0.49	0.56	1.04	1.10	1.15
s w	0.12	0.22	0.32	0.42	0.53	1.03	1.14	1.25	1.37	1.47	1.55
sw by w	0.18	0.33	0.48	1.03	1.19	1.35	1.52	2.10	2.30	2.45	3.00
w s w	0.29	0.53	1.17	1.42	2.09	2.37	3.09	3.45	4.32	5.31	
w by s	0.59	1.48	2.40	3.38	4.55						
West	6.00										
☉ fet	6.00	6.00	6.00	5.59	5.58	5.58	5.57	5.56	5.56	5.55	5.55



## A Sun-Dial for the Latitude of 4 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	Deg. Min.	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	North	12	12	12	12	12	12	12	12	12
s by w	0.01	n by w	0.01	0.03	0.05	0.07	0.09	0.11	0.13	0.15	0.17
s s w	0.02	n n w	0.02	0.06	0.10	0.14	0.19	0.23	0.28	0.32	0.35
sw by s	0.04	nw by n	0.03	0.09	0.16	0.23	0.30	0.38	0.45	0.52	0.57
s w	0.06	n w	0.04	0.14	0.24	0.35	0.46	0.57	1.09	1.19	1.27
sw byw	0.09	nw byw	0.06	0.21	0.37	0.53	1.10	1.28	1.47	2.04	2.17
w s w	0.14	w n w	0.10	0.35	1.01	1.29	2.00	2.36	3.21	4.17	
w by s	0.29	w by n	0.21	1.17	2.29						
West	3.25	West									
☉ fet	6.00	☉ fet	6.01	6.02	6.03	6.03	6.04	6.05	6.06	6.06	6.07
Sun's Ampl.	d m 2.30	Sun's Ampl.	d m 5.00	d m 7.31	d m 10.1	d m 12.31	d m 15.2	d m 17.32	d m 20.3	d m 22.3	d m 23.33

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.03	0.05	0.07	0.09	0.11	0.13	0.16	0.18	0.20	0.22	0.23
s s w	0.07	0.11	0.15	0.19	0.23	0.28	0.32	0.36	0.41	0.45	0.48
sw by s	0.11	0.17	0.24	0.31	0.38	0.45	0.52	0.59	1.07	1.13	1.18
s w	0.16	0.26	0.36	0.46	0.56	1.07	1.18	1.29	1.41	1.51	1.58
sw byw	0.24	0.39	0.54	1.09	1.25	1.41	1.58	2.15	2.35	2.51	3.04
w s w	0.38	1.02	1.26	1.51	2.17	2.45	3.17	3.52	4.38	5.33	
w by s	1.17	2.05	2.55	3.51	5.04						
West	6.00										
☉ fet	6.00	6.00	5.59	5.58	5.57	5.57	5.56	5.55	5.54	5.54	5.53



A Sun-Dial for the Latitude of 5 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	Deg. Min.	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	Point	h m	h m	h m	12 h m	h m	h m	h m	h m	h m
South	12	North	12	12	12	h m	12	12	12	12	12
s by w	0.02	n by w	Zen. West.	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16
s s w	0.04	n n w		0.04	0.08	0.13	0.18	0.22	0.26	0.30	0.33
sw by s	0.07	nw by n		0.07	0.14	0.21	0.28	0.35	0.43	0.49	0.54
s w	0.10	n w		0.10	0.20	0.31	0.42	0.53	1.05	1.15	1.22
sw by w	0.16	nw by w		0.15	0.31	0.47	1.04	1.21	1.40	1.57	2.10
w s w	0.24	w n w		0.25	0.51	1.18	1.49	2.24	3.08	4.00	
w by s	0.48	w by n		0.54	2.01						
West	4.00	West									
☉ fet	6.01	☉ fet	6.02	6.03	6.04	6.04	6.05	6.06	6.07	6.08	6.09
Sun's Ampl.	d m 2.30	Sun's Ampl.	d m 5.01	d m 7.31	d m 10.2	d m 12.32	d m 15.3	d m 17.34	d m 20.5	d m 22.5	d m 23.35

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24
s s w	0.08	0.12	0.17	0.21	0.25	0.29	0.34	0.38	0.43	0.47	0.50
sw by s	0.13	0.20	0.27	0.33	0.40	0.47	0.54	1.02	1.09	1.16	1.21
s w	0.20	0.30	0.40	0.50	1.00	1.11	1.22	1.33	1.45	1.55	2.02
sw by w	0.30	0.45	1.00	1.15	1.31	1.46	2.03	2.21	2.40	2.56	3.11
w s w	0.48	1.11	1.35	2.00	2.26	2.53	3.24	3.59	4.43	5.35	
w by s	1.35	2.21	3.09	4.03	5.11						
West	6.00										
☉ fets	6.00	5.59	5.58	5.57	5.56	5.56	5.55	5.54	5.53	5.52	5.51



## A Sun-Dial for the Latitude of 6 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	Deg. Min.	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23m 29m
Point	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	North	12	12	12	12	12	12	12	12
s by w	0.03	0.01	n by w	0.01	0.03	0.05	0.07	0.09	0.12	0.13	0.15
s s w	0.06	0.02	n n w	0.03	0.07	0.11	0.15	0.20	0.25	0.28	0.31
sw by s	0.09	0.03	nw by n	0.04	0.11	0.18	0.25	0.32	0.40	0.46	0.51
s w	0.14	0.04	n w	0.06	0.16	0.27	0.38	0.49	1.01	1.10	1.18
sw by w	0.21	0.06	nw b w	0.09	0.25	0.41	0.57	1.15	1.34	1.50	2.04
w s w	0.33	0.09	w n w	0.15	0.40	1.08	1.38	2.12	2.55	3.44	
w by s	1.06	0.20	w b n	0.32	1.34	3.24					
West	4.22	2.15	West								
☉ fet	6.01	6.02	☉ fet	6.03	6.04	6.05	6.06	6.07	6.09	6.10	6.11
Sun's Ampl.	d m	d m	Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m
	2.30	5.01		7.32	10.3	12.34	15.5	17.36	20.6	22.7	23.27

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.05	0.07	0.09	0.11	0.13	0.25	0.17	0.19	0.21	0.23	0.24
s s w	0.10	0.14	0.18	0.22	0.27	0.31	0.35	0.40	0.44	0.48	0.51
sw by s	0.16	0.23	0.29	0.36	0.43	0.50	0.57	1.04	1.12	1.18	1.23
s w	0.24	0.34	0.44	0.54	1.04	1.15	1.25	1.37	1.48	1.58	2.06
sw by w	0.36	0.50	1.05	1.20	1.36	1.52	2.08	2.26	2.45	3.01	3.15
w s w	0.57	1.20	1.44	2.08	2.34	3.01	3.31	4.06	4.48	5.37	
w by s	1.51	2.35	3.22	4.13	5.16						
West	6.00										
☉ fet	6.00	5.59	5.58	5.57	5.56	5.55	5.54	5.53	5.51	5.50	5.49



A Sun-Dial for the Latitude of 7 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	Deg. Min.	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	Point	h m	h m	12	h m	h m	h m	h m	h m
South	12	12	North	12	12	h m	12	12	12	12	12
s by w	0.04	0.02	n by w	0.00	0.02	0.04	0.07	0.09	0.11	0.13	0.14
s s w	0.07	0.03	n n w	0.01	0.05	0.09	0.14	0.18	0.23	0.27	0.30
sw by s	0.12	0.05	nw by n	0.01	0.08	0.15	0.22	0.29	0.37	0.44	0.48
s w	0.18	0.08	n w	0.02	0.12	0.23	0.33	0.45	0.56	1.00	1.14
sw by w	0.27	0.12	nw by w	0.03	0.18	0.34	0.51	1.08	1.27	1.43	1.57
w s w	0.43	0.19	w n w	0.05	0.30	0.57	1.27	2.00	2.42	3.28	
w by s	1.23	0.39	w by n	0.10	1.08	2.36					
West	4.37	2.58									
⊙ set	6.01	6.02	⊙ set	6.03	6.05	6.06	6.08	6.09	6.10	6.11	6.12
Sun's Ampl.	d m 2.31	d m 5.02	Sun's Ampl.	d m 7.33	d m 10.2	d m 12.35	d m 15.7	d m 17.38	d m 20.9	d m 22.10	d m 23.40

SOUTH DECLINATION.

Deg. Min.	0 d 30m	2 d	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.06	0.07	0.09	0.11	0.13	0.16	0.18	0.20	0.22	0.24	0.25
s s w	0.12	0.16	0.20	0.24	0.28	0.33	0.37	0.41	0.46	0.50	0.53
sw by s	0.19	0.25	0.32	0.39	0.45	0.52	0.59	1.07	1.15	1.21	1.25
s w	0.28	0.38	0.48	0.58	1.08	1.18	1.29	1.40	1.52	2.02	2.09
sw by w	0.41	0.56	1.11	1.26	1.41	1.57	2.14	2.31	2.50	3.07	3.19
w s w	1.06	1.29	1.52	2.16	2.41	3.08	3.38	4.12	4.52	5.39	
w by s	2.06	2.49	3.33	4.22	5.20						
West	6.00										
⊙ sets	6.00	5.59	5.58	5.57	5.55	5.54	5.52	5.51	5.50	5.49	5.48



## A Sun-Dial for the Latitude of 8 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	Deg. Min.	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23m 29m
Point	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	North	12	12	12	12	12	12	12
s by w	0.04	0.02	0.00	n by w	0.02	0.04	0.06	0.08	0.10	0.12	0.13
s s w	0.09	0.05	0.01	n n w	0.03	0.08	0.12	0.16	0.21	0.25	0.28
sw by s	0.15	0.08	0.01	nw by n	0.05	0.12	0.20	0.27	0.34	0.41	0.45
s w	0.22	0.12	0.02	n w	0.08	0.18	0.29	0.40	0.52	1.02	1.09
sw by w	0.33	0.18	0.03	nw b w	0.12	0.28	0.45	1.02	1.20	1.35	1.49
w s w	0.52	0.29	0.05	w n w	0.20	0.46	1.16	1.48	2.28	3.11	4.06
w by s	1.39	0.56	0.10	w b n	0.44	1.59					
West	4.48	3.26	1.22	West							
☉ fet	6.01	6.03	6.04	☉ fet	6.06	6.07	6.09	6.10	6.12	6.13	6.14
Sun's Ampl.	d m	d m	d m	Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m
	2.31	5.02	7.34		10.6	12.38	15.9	17.40	20.12	22.13	23.45

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.21	0.23	0.25	0.26
s s w	0.13	0.17	0.21	0.26	0.30	0.34	0.38	0.43	0.47	0.51	0.54
sw by s	0.21	0.28	0.34	0.41	0.48	0.55	1.02	1.09	1.17	1.23	1.28
s w	0.32	0.41	0.51	1.01	1.11	1.22	1.33	1.44	1.55	2.05	2.13
sw by w	0.47	1.02	1.16	1.31	1.46	2.02	2.19	2.36	2.55	3.09	3.22
w s w	1.14	1.37	2.00	2.24	2.48	3.15	3.44	4.17	4.56	5.39	
w by s	2.20	3.01	3.44	4.30	5.24						
West	6.00										
☉ fet	6.00	5.59	5.57	5.56	5.54	5.53	5.51	5.50	5.48	5.47	5.46



A Sun-Dial for the Latitude of 9 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d 30m	7 d 30m	Deg. Min.	10 d 30m	12 d 30m	15 d 30m	17 d 30m	20 d 30m	22 d 30m	23 d 29m
Point	h m	h m	h m	Point	h m	12	h m	h m	h m	h m	h m
South	12	12	12	North	12	h m	12	12	12	12	12
s by w	0.05	0.03	0.01	n by w	0.01	0.03	0.05	0.07	0.09	0.11	0.12
s s w	0.11	0.07	0.03	n n w	0.02	0.06	0.10	0.14	0.19	0.23	0.26
w by s	0.17	0.11	0.04	nw by w	0.03	0.10	0.17	0.24	0.31	0.38	0.43
s w	0.26	0.16	0.06	n w	0.04	0.14	0.25	0.36	0.47	0.57	1.05
w by w	0.38	0.24	0.09	nw by w	0.06	0.22	0.38	0.55	1.13	1.30	1.42
w s w	1.00	0.38	0.14	w n w	0.10	0.36	1.04	1.36	2.15	2.55	3.42
w by s	1.53	1.13	0.29	w by n	0.21	1.27					
West	4.56	3.46	2.15								
☉ set	6.01	6.03	6.04	☉ set	6.06	6.08	6.10	6.12	6.14	6.15	6.16
Sun's Ampl.	d m	d m	d m	Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m
	2.31	5.03	7.35		10.7	12.39	15.11	17.43	20.16	22.18	23.59

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d 30m	7 d 30m	10 d 30m	12 d 30m	15 d 30m	17 d 30m	20 d 30m	22 d 30m	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.26
s s w	0.15	0.19	0.23	0.27	0.31	0.36	0.40	0.44	0.49	0.52	0.56
w by s	0.24	0.30	0.37	0.44	0.50	0.57	1.04	1.12	1.19	1.25	1.31
s w	0.36	0.45	0.55	1.05	1.15	1.26	1.36	1.47	1.59	2.09	2.16
w by w	0.53	1.07	1.22	1.36	1.52	2.07	2.24	2.41	2.59	3.14	3.28
w s w	1.23	1.45	2.08	2.31	2.55	3.21	3.50	4.22	5.00	5.40	
w by s	2.33	3.12	3.53	4.35	5.27						
West	6.00										
☉ sets	6.00	5.59	5.57	5.56	5.54	5.52	5.50	5.48	5.46	5.45	5.44



## A Sun-Dial for the Latitude of 10 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	Deg. Min.	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0.06	0.04	0.02	Zen. West	n by w	0.02	0.04	0.06	0.08	0.10	0.12
s s w	0.12	0.08	0.04		n n w	0.04	0.09	0.13	0.18	0.21	0.24
sw by s	0.20	0.13	0.07		nw by n	0.07	0.14	0.21	0.29	0.35	0.40
s w	0.30	0.20	0.10		n w	0.10	0.21	0.32	0.43	0.53	1.00
sw by w	0.44	0.30	0.15		nw b w	0.15	0.32	0.49	1.06	1.23	1.35
w s w	1.09	0.47	0.24		w n w	0.25	0.53	1.24	2.01	2.39	3.19
w by s	2.07	1.28	0.47		w b n	0.59	1.07				
West	5.03	4.01	2.47		West						
☉ fet	6.02	6.04	6.05	6.07	☉ fet	6.09	6.11	6.13	6.15	6.16	6.17
Sun's Ampl.	d m	d m	d m	d m	Sun's Ampl.	d m	d m	d m	d m	d m	d m
	2.32	5.05	7.37	10.10		12.42	15.15	17.47	20.20	22.22	23.54

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.27
s s w	0.16	0.21	0.25	0.29	0.33	0.37	0.42	0.46	0.51	0.54	0.57
sw by s	0.26	0.33	0.40	0.46	0.53	1.00	1.07	1.14	1.22	1.28	1.33
s w	0.39	0.49	0.59	1.09	0.19	1.29	1.40	1.51	2.02	2.12	2.19
sw by w	0.58	1.13	1.27	1.42	1.57	2.12	2.28	2.45	3.03	3.19	3.32
w s w	1.31	1.53	2.15	2.38	3.02	3.27	3.55	4.26	5.03	5.41	
w by s	2.44	3.22	4.01	4.42	5.29						
West	6.00										
☉ fet	6.00	5.58	5.56	5.55	5.53	5.51	5.49	5.47	5.45	5.44	5.43



A Sun-Dial for the Latitude of 11 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	Deg. Min.	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0.07	0.05	0.03	0.01	n by w	0.01	0.03	0.05	0.07	0.09	0.11
s s w	0.14	0.10	0.06	0.02	n n w	0.02	0.07	0.11	0.16	0.20	0.22
sw by s	0.22	0.16	0.09	0.03	nw by n	0.04	0.11	0.18	0.26	0.32	0.37
s w	0.34	0.24	0.14	0.04	n w	0.06	0.17	0.28	0.39	0.49	0.56
sw by w	0.50	0.35	0.21	0.06	nw by w	0.09	0.25	0.42	1.00	1.15	1.28
w s w	1.17	0.56	0.33	0.08	w n w	0.15	0.41	1.12	1.47	2.23	2.59
w by s	2.19	1.43	1.03	0.20	w by n	0.33	1.55				
West	5.08	4.13	3.09	1.40							
☉ fet	6.02	6.04	6.06	6.08	☉ fet	6.10	6.12	6.14	6.16	6.18	6.19
Sun's Ampl.	d m	d m	d m	d m	Sun's Ampl.	d m	d m	d m	d m	d m	d m
	2.32	5.05	7.38	10.11		12.44	15.17	17.50	20.24	22.27	23.59

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	29 d 23m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.28
s s w	0.18	0.22	0.26	0.30	0.34	0.39	0.43	0.47	0.52	0.56	0.59
sw by s	0.29	0.36	0.42	0.49	0.55	1.02	1.09	1.16	1.24	1.30	1.35
s w	0.43	0.53	1.03	1.12	1.22	1.33	1.43	1.54	2.05	2.15	2.22
sw by w	1.04	1.18	1.32	1.47	2.01	2.17	2.33	2.49	3.07	3.23	3.35
w s w	1.39	2.01	2.22	2.45	3.08	3.33	4.00	4.30	5.05	5.41	
w by s	2.55	3.31	4.08	4.47	5.31						
West	6.00										
☉ fet	6.00	5.58	5.56	5.54	5.52	5.50	5.48	5.46	5.44	5.42	5.41



## A Sun-Dial for the Latitude of 12 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	Deg. Min.	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0.07	0.06	0.04	0.02	n by w	0.00	0.02	0.04	0.07	0.09	0.10
s s w	0.16	0.12	0.08	0.04	n n w	0.01	0.05	0.10	0.14	0.18	0.21
sw by s	0.25	0.19	0.12	0.05	nw by n	0.01	0.08	0.15	0.23	0.29	0.34
s w	0.37	0.28	0.18	0.08	n w	0.02	0.12	0.23	0.35	0.44	0.51
sw by w	0.55	0.41	0.27	0.12	nw b w	0.03	0.19	0.35	0.53	1.09	1.21
w s w	1.25	1.04	0.42	0.19	w n w	0.05	0.31	1.00	1.34	2.07	2.40
w by s	2.31	1.56	1.19	0.38	w b n	0.11	1.17				
West	5.12	4.23	3.27	2.16							
☉ fet	6.02	6.04	6.06	6.09	☉ fet	6.11	6.13	6.15	6.18	6.20	6.21
Sun's Ampl.	d m	d m	d m	d m	Sun's Ampl.	d m	d m	d m	d m	d m	d m
	2.33	5.07	7.40	10.13		12.48	15.20	17.54	20.28	22.31	24.5

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29
s s w	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.49	0.53	0.57	1.00
sw by s	0.32	0.38	0.45	0.51	0.58	1.05	1.12	1.19	1.26	1.32	1.37
s w	0.47	0.56	1.06	1.16	1.26	1.36	1.46	1.57	2.18	2.18	2.25
sw by w	1.09	1.23	1.37	1.52	2.06	2.21	2.37	2.53	3.11	3.27	3.39
w s w	1.47	2.07	2.29	2.51	3.14	3.38	4.04	4.33	5.07	5.41	
w by s	3.05	3.39	4.14	4.51	5.32						
West	6.00										
☉ fet	6.00	5.58	5.56	5.54	5.51	5.49	5.47	5.45	5.42	5.40	5.39



A Sun-Dial for the Latitude of 13 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	Deg. Min.	15 d	17 d 30m	20 d	22 d	23 m 29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0.08	0.06	0.04	0.02	0.00	n by w	0.02	0.04	0.06	0.08	0.09
s s w	0.17	0.13	0.09	0.05	0.01	n n w	0.03	0.08	0.12	0.16	0.19
sw by s	0.28	0.21	0.15	0.08	0.01	nw by n	0.06	0.13	0.20	0.26	0.31
s w	0.41	0.31	0.22	0.12	0.02	n w	0.08	0.19	0.30	0.40	0.47
sw by w	1.01	0.47	0.32	0.18	0.03	nw by w	0.13	0.29	0.46	1.01	1.13
w s w	2.33	1.12	0.51	0.28	0.05	w n w	0.21	0.49	1.21	1.52	2.22
w by s	2.41	2.08	1.33	0.54	0.10	w by n	0.48				
West	5.16	4.31	3.41	2.41	1.05						
⊙ fet	6.02	6.05	6.07	6.09	6.11	⊙ fet	6.14	6.16	6.19	6.21	6.23
Sun's Ampl.	d m 2.34	d m 5.08	d m 7.42	d m 10.16	d m 12.49	Sun's Ampl.	d m 15.24	d m 17.59	d m 20.33	d m 22.37	d m 24.11

SOUTH DECLINATION

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.29
s s w	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.55	0.59	1.02
sw by s	0.34	0.41	0.47	0.54	1.00	1.07	1.14	1.21	1.28	1.34	1.39
s w	0.51	1.00	1.10	1.19	1.29	1.39	1.50	2.01	2.12	2.21	2.29
sw by w	1.14	1.28	1.42	1.56	2.11	2.26	2.41	2.58	3.15	3.30	3.42
w s w	1.54	2.15	2.36	2.57	3.20	3.43	4.08	4.37	5.09	5.40	
w by s	3.14	3.47	4.20	4.55	5.34						
West	6.00										
⊙ fet	6.00	5.58	5.55	5.53	5.51	5.49	5.46	5.44	5.41	5.39	5.37



## A Sun-Dial for the Latitude of 14 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 3om	5 d	7 d 3om	10 d	12 d 3om	Deg. Min.	15 d	17 d 3om	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0.09	0.07	0.05	0.03	0.01	n by w	0.01	0.03	0.05	0.07	0.08
s s w	0.19	0.15	0.11	0.07	0.03	n n w	0.02	0.06	0.10	0.14	0.17
sw by s	0.30	0.24	0.17	0.11	0.04	nwbyn	0.03	0.10	0.17	0.23	0.28
s w	0.45	0.35	0.26	0.16	0.06	n w	0.04	0.15	0.26	0.35	0.43
sw by w	1.06	0.52	0.38	0.24	0.09	nw bw	0.06	0.22	0.40	0.54	1.06
w s w	1.41	1.20	0.59	0.38	0.15	w n w	0.10	0.37	1.08	1.38	2.05
w by s	2.52	2.19	1.46	1.10	0.29	w by n	0.22	1.48			
West	3.19	4.38	3.53	3.00	1.49	West					
☉ fet	6.02	6.05	6.07	6.10	6.12	☉ fet	6.15	6.18	6.21	6.23	6.25
Sun's Ampl.	d m	d m	d m	d m	d m	Sun's Ampl.	d m	d m	d m	d m	d m
	2.34	5.09	7.44	10.19	12.53		15.28	18.3	20.38	22.43	24.16

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 3om	5 d	d om	10 d	12 d 3om	15 d	17 d 3om	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.30
s s w	0.23	0.27	0.31	0.35	0.39	0.44	0.48	0.52	0.57	1.01	1.03
sw by s	0.37	0.43	0.50	0.56	1.03	1.10	1.16	1.23	1.31	1.36	1.41
s w	0.54	1.04	1.13	1.23	1.33	1.43	1.53	2.04	2.15	2.24	2.31
sw by w	1.20	1.33	1.47	2.01	2.15	2.30	2.45	3.02	3.19	3.33	3.45
w s w	2.01	2.21	2.42	3.03	3.25	3.48	4.12	4.40	5.11		
w by s	3.22	3.53	4.25	4.59	5.35						
West	6.00										
☉ fet	6.00	5.58	5.55	5.53	5.50	5.48	5.45	5.42	5.39	5.37	5.35



A Sun-Dial for the Latitude of 15 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	Deg. Min.	15 d	17 d 30m	20 d	22 d	23m 29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0.10	0.08	0.06	0.04	0.02	n by w	Zen. West	0.02	0.04	0.06	0.07
s s w	0.21	0.16	0.12	0.08	0.04	n n w		0.04	0.09	0.12	0.15
sw by s	0.33	0.26	0.20	0.13	0.07	nw by n		0.07	0.14	0.20	0.25
s w	0.49	0.39	0.30	0.20	0.10	n w		0.11	0.22	0.31	0.38
sw by w	1.11	0.58	0.44	0.30	0.15	nw by w		0.16	0.33	0.47	0.59
w s w	1.48	1.28	1.08	0.47	0.24	w n w		0.26	0.56	1.24	1.50
w by s	3.00	2.30	1.58	1.24	0.46	w by n		1.06			
West	5.22	4.44	4.02	3.15	2.17	West					
☉ set	6.02	6.05	6.08	6.11	6.13	☉ set	6.16	6.19	6.22	6.25	6.27
Sun's Ampl.	d m 2.35	d m 5.10	d m 7.46	d m 10.21	d m 12.56	Sun's Ampl.	d m 15.32	d m 18.8	d m 20.44	d m 22.49	d m 24.24

SOUTH DECLINATION

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.31
s s w	0.24	0.28	0.32	0.36	0.40	0.45	0.49	0.53	0.58	1.02	1.04
sw by s	0.39	0.46	0.52	0.59	1.05	1.12	1.18	1.25	1.33	1.39	1.43
s w	0.58	1.07	1.17	1.26	1.36	1.46	1.56	2.07	2.18	2.27	2.34
sw by w	1.25	1.38	1.52	2.06	2.20	2.34	2.49	3.05	3.22	3.37	3.48
w s w	2.08	2.28	2.48	3.08	3.29	3.52	4.16	4.42	5.12		
w by s	3.30	4.00	4.30	5.02	5.36						
West	6.00										
☉ set	6.00	5.58	5.55	5.52	5.49	5.47	5.44	5.41	5.38	5.35	5.33



## A Sun-Dial for the Latitude of 16 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	Deg. Min.	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m
South	12	12	12	12	12	12	North	12	12	12	12
s by w	0.11	0.09	0.07	0.05	0.03	0.01	n by w	0.01	0.03	0.05	0.07
s s w	0.22	0.18	0.14	0.10	0.06	0.02	n n w	0.03	0.07	0.11	0.14
sw by s	0.35	0.29	0.23	0.16	0.10	0.03	nw by n	0.04	0.11	0.17	0.22
s w	0.52	0.43	0.34	0.24	0.14	0.04	n w	0.06	0.17	0.26	0.33
sw byw	1.16	1.03	0.49	0.35	0.21	0.06	nw byw	0.10	0.26	0.40	0.52
w s w	1.55	1.36	1.16	0.55	0.33	0.10	w n w	0.16	0.44	1.11	1.34
w by s	3.08	2.39	2.09	1.37	1.02	0.20	w by n	0.36			
West	5.25	4.49	4.11	3.28	2.37	1.23					
☉ fet	6.03	6.06	6.09	6.12	6.15	6.18	☉ fet	6.21	6.24	6.27	6.29
Sun's Ampl.	d m	d m	d m	d m	d m	d m	Sun's Ampl.	m d m	d m	d m	d m
	2.36	5.12	7.48	10.24	13.0	15.37		18.13	20.51	22.56	24.32

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.13	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32
s s w	0.26	0.30	0.34	0.38	0.42	0.46	0.50	0.55	0.59	1.03	1.06
sw by s	0.42	0.48	0.54	1.01	1.07	1.14	1.21	1.28	1.35	1.41	1.45
s w	1.02	1.11	1.20	1.29	1.39	1.49	1.59	2.10	2.21	2.30	2.37
sw byw	1.30	1.43	1.56	2.10	2.24	2.38	2.53	3.09	3.25	3.40	3.51
w s w	2.15	2.34	2.54	3.14	3.34	3.56	4.19	4.45	5.13		
w by s	3.37	4.05	4.34	5.04	5.36						
West	6.00										
☉ fet	6.00	5.57	5.54	5.51	5.48	5.45	5.42	5.39	5.36	5.33	5.31



A Sun-Dial for the Latitude of 17 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	Deg. Min.	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m
South	12	12	12	12	12	12	North	12	12	12	12
s by w	0.11	0.09	0.07	0.06	0.04	0.02	n by w	0.00	0.02	0.04	0.06
s s w	0.24	0.20	0.16	0.12	0.08	0.03	n n w	0.01	0.05	0.09	0.12
sw by s	0.38	0.32	0.25	0.19	0.13	0.06	nwbyn	0.01	0.08	0.15	0.19
s w	0.56	0.47	0.38	0.28	0.18	0.08	n w	0.02	0.13	0.22	0.29
sw by w	1.21	1.08	0.55	0.41	0.27	0.12	nw bw	0.03	0.19	0.33	0.45
w s w	2.02	1.43	1.23	1.03	0.42	0.19	w n w	0.05	0.33	0.58	1.20
w by s	3.16	2.48	2.20	1.49	1.16	0.37	w byn	0.11	1.36		
West	5.27	4.53	4.18	3.39	2.54	1.55					
w by n					5.50	5.11					
☉ set	6.03	6.06	6.09	6.12	6.15	6.19	☉ set	6.22	6.25	6.28	6.31
Sun's Ampl.	d m	d m	d m	d m	d m	d m	Sun's Ampl.	d m	d m	d m	d m
	2.36	5.13	7.50	10.28	13.04	15.42		18.19	20.57	23.4	24.40

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33
s s w	0.28	0.32	0.36	0.39	0.43	0.47	0.52	0.56	1.01	1.04	1.07
sw by s	0.44	0.50	0.57	1.03	1.09	1.16	1.23	1.30	1.37	1.43	1.47
s w	1.05	1.14	1.24	1.33	1.42	1.51	2.02	2.13	2.23	2.32	2.39
sw by w	1.35	1.48	2.01	2.14	2.28	2.42	2.57	3.12	3.29	3.42	3.54
w s w	2.21	2.40	2.59	3.18	3.39	4.00	4.22	4.47	5.14		
w by s	3.43	4.10	4.38	5.07	5.37						
West	6.00										
☉ set	6.00	5.57	5.54	5.51	5.48	5.45	5.41	5.38	5.35	5.32	5.29



## A Sun-Dial for the Latitude of 18 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 3om	5 d	7 d 3om	10 d	12 d 3om	15 d	17 d 3om	Deg. Min.	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.12	0.10	0.08	0.06	0.04	0.02	0.00	n by w	0.02	0.03	0.05
s s w	0.25	0.21	0.17	0.13	0.09	0.05	0.01	n n w	0.04	0.07	0.10
sw by s	0.40	0.34	0.28	0.21	0.15	0.09	0.01	nw by n	0.06	0.12	0.16
s w	1.00	0.50	0.41	0.32	0.22	0.12	0.02	n w	0.09	0.17	0.24
sw byw	1.26	1.13	1.00	0.47	0.32	0.18	0.03	nw bw	0.13	0.27	0.38
w s w	2.08	1.50	1.31	1.11	0.51	0.29	0.05	w n w	0.21	0.45	1.06
w by s	3.23	2.57	2.29	2.00	1.29	0.53	0.10	w by n	0.53		
West	5.29	4.57	4.24	3.49	3.08	2.18	0.56	West			
w by n					5.51	5.15	4.32				
☉ set	6.03	6.06	6.09	6.13	6.16	6.20	6.23	☉ set	6.27	6.30	6.33
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	Sun's Ampl.	d m	d m	d m
	2.37	5.15	7.53	10.31	13.9	15.47	18.26		21.4	23.12	24.49

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 3om	5 d	7 d 3om	10 d	12 d 3om	15 d	17 d 3om	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.33
s s w	0.29	0.33	0.37	0.41	0.45	0.49	0.53	0.58	1.02	1.06	1.08
sw by s	0.47	0.53	0.59	1.05	1.12	1.18	1.25	1.32	1.39	1.45	1.49
s w	1.09	1.18	1.27	1.36	1.46	1.55	2.05	2.15	2.26	2.35	2.42
sw byw	1.39	1.52	2.05	2.18	2.32	2.45	3.00	3.15	3.31	3.45	3.56
w s w	2.27	2.45	3.04	3.23	3.43	4.03	4.25	4.49	5.15		
w by s	3.49	4.15	4.41	5.09	5.38						
West	6.00										
☉ set	6.00	5.57	5.54	5.51	5.47	5.44	5.40	5.37	5.33	5.30	5.27



A Sun-Dial for the Latitude of 19 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	Deg. Min.	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.13	0.11	0.09	0.07	0.05	0.03	0.01	n by w	0.01	0.03	0.04
s s w	0.27	0.23	0.19	0.15	0.11	0.07	0.03	n n w	0.02	0.05	0.08
sw by s	0.43	0.37	0.30	0.24	0.18	0.11	0.05	nwbyn	0.03	0.09	0.13
s w	1.03	0.54	0.45	0.36	0.26	0.17	0.07	n w	0.04	0.13	0.20
sw by w	1.31	1.18	1.05	0.52	0.38	0.24	0.09	nw bw	0.06	0.20	0.31
w s w	2.15	1.57	1.38	1.19	0.59	0.37	0.15	w n w	0.10	0.33	0.53
w by s	3.30	3.04	2.38	2.11	1.41	1.08	0.29	w byn	0.23		
West	5.31	5.01	4.30	3 57	3.20	2.36	1.35				
w by n					5.52	5.19	4.40				
☉ set	6.03	6.07	6.10	6.14	6.17	6.21	6.25	☉ set	6.28	6.31	6.34
Sun's Ampl.	2.38	5.17	7.56	10.35	13.14	15.53	18.33	Sun's Ampl.	21.12	23.58	24.58

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.30	0.32	0.34
s s w	0.31	0.35	0.38	0.42	0.46	0.50	0.54	0.59	1.03	1.07	1.09
sw by s	0.49	0.55	1.01	1.08	1.14	1.21	1.27	1.34	1.41	1.47	1.51
s w	1.12	1.21	1.30	1.39	1.48	1.58	2.07	2.18	2.29	2.37	2.44
sw by w	1.44	1.57	2.09	2.23	2.36	2.49	3.04	3.19	3.34	3.48	3.58
w s w	2.33	2.51	3.09	3.27	3.46	4.06	4.28	4.51	5.16		
w by s	3.54	4.19	4.44	5.10	5.39						
West	6.00										
☉ set	6.00	5.57	5.53	5.50	5.46	5.43	5.39	5.35	5.32	5.29	5.26



## A Sun-Dial for the Latitude of 20 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	Deg. Min.	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.14	0.12	0.10	0.08	0.06	0.04	0.02	n by w	Zen. Welt	0.02	0.03
s s w	0.28	0.25	0.21	0.17	0.13	0.09	0.05	n n w		0.04	0.06
sw by s	0.45	0.39	0.32	0.26	0.20	0.14	0.07	nw by n		0.06	0.10
s w	1.07	0.58	0.49	0.40	0.30	0.21	0.11	n w		0.09	0.16
sw byw	1.36	1.23	1.10	0.58	0.44	0.30	0.15	nw bw		0.13	0.24
w s w	2.21	2.03	1.45	1.26	1.07	0.46	0.24	w n w		0.22	0.40
w by s	3.36	3.11	2.45	2.20	1.52	1.21	0.45	w by n			
West	5.32	5.04	4.35	4.04	3.30	2.50	2.00	West			
w by n					5.54	5.23	4.47				
☉ fet	6.03	6.07	6.11	6.15	6.18	6.22	6.26	☉ fet	6.30	6.33	6.36
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	Sun's Ampl.	d m	d m	d m
	2.40	5.19	7.59	10.39	13.19	16.0	18.40		21.20	23.29	25.8

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.16	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.34
s s w	0.32	0.36	0.40	0.44	0.48	0.52	0.56	1.00	1.05	1.08	1.11
sw by s	0.51	0.58	1.04	1.10	1.16	1.23	1.29	1.36	1.43	1.49	1.53
s w	1.16	1.24	1.33	1.42	1.51	2.01	2.10	2.20	2.31	2.40	2.47
sw byw	1.48	2.01	2.14	2.26	2.39	2.53	3.07	3.22	3.37	3.50	4.00
w s w	2.38	2.56	3.13	3.31	3.50	4.09	4.30	4.52	5.16		
w by s	3.59	4.23	4.47	5.12	5.39						
West	6.00										
☉ fet	6.00	5.57	5.53	5.49	5.45	5.42	5.38	5.34	5.30	5.27	5.24



A Sun-Dial for the Latitude of 21 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 3om	5 d	7 d 3om	10 d	12 d 3om	15 d	17 d 3om	20 d	Deg. Min.	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m
South	12	12	12	12	12	12	12	12	North	12	12
s by w	0.14	0.13	0.11	0.09	0.07	0.05	0.03	0.01	n by w	0.01	0.02
s s w	0.30	0.26	0.22	0.18	0.14	0.10	0.06	0.02	n n w	0.02	0.04
sw by s	0.48	0.42	0.35	0.29	0.23	0.16	0.10	0.03	nw by n	0.03	0.07
s w	1.10	1.01	0.52	0.43	0.34	0.24	0.15	0.04	n w	0.04	0.11
sw by w	1.40	1.28	1.15	1.03	0.49	0.36	0.21	0.06	nw by w	0.06	0.17
w s w	2.26	2.09	1.52	1.34	1.15	0.55	0.33	0.10	w n w	0.11	0.28
w by s	3.41	3.18	2.54	2.29	2.03	1.33	1.00	0.20	w by n	0.24	
West	5.34	5.07	4.40	4.11	3.39	3.03	2.19	1.14			
w by n					5.55	5.26	4.53	4.12			
☉ set	6.04	6.08	6.12	6.16	6.20	6.24	6.28	6.32	☉ set	6.35	6.38
Sun's Ampl.	d m 2.41	d m 5.21	d m 8.02	d m 10.43	d m 13.24	d m 16.6	d m 18.47	d m 21.29	Sun's Ampl.	d m 23.39	d m 25.18

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 3om	5 d	7 d 3om	10 d	12 d 3om	15 d	17 d 3om	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.34	0.35
s s w	0.34	0.38	0.42	0.45	0.49	0.54	0.58	1.02	1.06	1.10	1.12
sw by s	0.54	1.00	1.06	1.12	1.19	1.25	1.32	1.38	1.45	1.51	1.55
s w	1.19	1.28	1.37	1.46	1.54	2.04	2.13	2.23	2.33	2.42	2.49
sw by w	1.53	2.05	2.18	2.30	2.43	2.56	3.10	3.24	3.39	3.52	4.02
w s w	2.43	3.01	3.18	3.35	3.54	4.12	4.32	4.53	5.17		
w by s	4.04	4.27	4.50	5.14	5.39						
West	6.00										
☉ set	6.00	5.56	5.52	5.48	5.44	5.40	5.36	5.32	5.28	5.25	5.22



## A Sun-Dial for the Latitude of 22 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	Deg. Min.	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m
South	12	12	12	12	12	12	12	12	North	12	12
s by w	0.15	0.13	0.11	0.09	0.08	0.06	0.04	0.02	n by w	Zen. West	0.01
s s w	0.31	0.28	0.24	0.20	0.16	0.12	0.08	0.04	n n w		0.03
sw by s	0.50	0.44	0.38	0.32	0.25	0.19	0.13	0.06	nw by n		0.04
s w	1.14	1.05	0.56	0.47	0.38	0.29	0.19	0.08	n w		0.07
sw by w	1.45	1.33	1.20	1.08	0.55	0.41	0.27	0.13	nw byw		0.10
w s w	2.32	2.15	1.58	1.40	1.22	1.03	0.42	0.20	w n w		0.17
w by s	3.46	3.24	3.01	2.38	2.12	1.45	1.14	0.37			
West	5.35	5.10	4.44	4.17	3.47	3.14	2.35	1.43			
w by n					5.56	5.28	4.58	4.21			
☉ fet	6.04	6.08	6.12	6.16	6.21	6.25	6.29	6.34	☉ fet	6.37	6.40
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	Sun's Ampl.	d m	d m
	2.42	5.23	8.05	10.48	13.30	16.13	18.55	21.39		23.50	25.29

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.17	0.19	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.35
s s w	0.35	0.39	0.43	0.47	0.50	0.55	0.59	1.03	1.07	1.11	1.13
sw by s	0.56	1.02	1.08	1.14	1.21	1.27	1.33	1.40	1.47	1.52	1.57
s w	1.22	1.31	1.40	1.49	1.58	2.07	2.16	2.25	2.36	2.44	2.51
sw by w	1.57	2.09	2.21	2.34	2.46	2.59	3.13	3.27	3.42	3.54	4.04
w s w	2.49	3.05	3.22	3.39	3.57	4.15	4.34	4.55	5.17		
w by s	4.08	4.30	4.52	5.15	5.39						
West	6.00										
☉ fet	6.00	5.56	5.52	5.48	5.44	5.39	5.35	5.31	5.26	5.23	5.20



A Sun-Dial for the Latitude of 23 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 3om	5 d	7 d 3om	10 d	12 d 3om	15 d	17 d 3om	20 d	22 d	Deg. Min.	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m
South	12	12	12	12	12	12	12	12	12	North	12
s by w	0.16	0.14	0.12	0.11	0.09	0.07	0.05	0.03	0.01	n by w	0.00
s s w	0.33	0.30	0.26	0.22	0.18	0.14	0.10	0.05	0.02	n n w	0.01
sw by s	0.53	0.47	0.41	0.34	0.28	0.22	0.16	0.09	0.03	nw by n	0.01
s w	1.17	1.08	1.00	0.50	0.41	0.32	0.23	0.13	0.04	n w	0.02
sw by w	1.49	1.37	1.25	1.13	1.00	0.47	0.33	0.19	0.06	nw by w	0.03
w s w	2.37	2.21	2.04	1.47	1.29	1.11	0.51	0.29	0.10	w n w	0.06
w by s	3.51	3.30	3.08	2.45	2.21	1.55	1.26	0.54	0.20		
West	5.36	5.12	4.48	4.22	3.54	3.23	2.48	2.04	1.11		
w by n				6.21	5.57	5.31	4.02	4.29	3.56		
☉ fet	6.04	6.09	6.13	6.17	6.22	6.26	6.31	6.36	6.39	☉ fet	6.42
Sun's Ampl.	d m 2.42	d m 5.26	d m 8.10	d m 10.52	d m 13.36	d m 16.20	d m 19.4	d m 21.49	d m 24.1	Sun's Ampl.	d m 25.41

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 3om	5 d	7 d 3om	10 d	12 d 3om	15 d	17 d 3om	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.18	0.20	0.22	0.24	0.26	0.28	0.29	0.31	0.33	0.35	0.36
s s w	0.37	0.41	0.44	0.48	0.51	0.56	1.00	1.04	1.08	1.12	1.15
sw by s	0.59	1.04	1.10	1.16	1.23	1.29	1.35	1.42	1.49	1.54	1.59
s w	1.25	1.34	1.43	1.51	2.01	2.10	2.19	2.28	2.38	2.46	2.53
sw by w	2.01	2.13	2.25	2.37	2.50	3.02	3.16	3.29	3.44	3.56	4.06
w s w	2.53	3.10	3.26	3.43	4.00	4.17	4.36	4.56	5.17		
w by s	4.12	4.33	4.54	5.16	5.39						
West	6.00										
☉ fet	6.00	5.56	5.51	5.47	5.43	5.38	5.34	5.29	5.24	5.21	5.18



## A Sun-Dial for the Latitude of 24 Degrees.

## NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	21	12	12	12	12	12	12
s by w	0.17	0.15	0.13	0.11	0.09	0.08	0.06	0.04	0.02	0.00
s s w	0.35	0.31	0.27	0.23	0.19	0.15	0.11	0.07	0.04	0.01
sw by s	0.55	0.49	0.43	0.37	0.30	0.24	0.18	0.11	0.06	0.01
s w	1.20	1.12	1.03	0.53	0.44	0.35	0.27	0.17	0.09	0.02
sw by w	1.54	1.42	1.30	1.18	1.05	0.52	0.39	0.24	0.13	0.03
w s w	2.42	2.26	2.10	1.53	1.36	1.18	0.59	0.38	0.20	0.05
w by s	3.56	3.35	3.14	2.52	2.29	2.05	1.38	1.07	0.38	0.10
West	5.37	5.15	4.51	4.27	4.01	3.32	3.00	2.21	1.39	0.50
w by n				6.21	5.58	5.33	5.06	4.35	4.06	3.39
w n w									6.24	6.09
☉ fet	6.04	6.09	6.13	6.18	6.23	6.27	6.32	6.37	6.41	6.44
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	2.44	5.28	8.13	10.57	13.47	16.27	19.13	21.59	24.12	25.54

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.18	0.20	0.22	0.24	0.26	0.28	0.29	0.31	0.33	0.35	0.37
s s w	0.38	0.42	0.46	0.50	0.53	0.57	1.01	1.05	1.10	1.13	1.16
sw by s	1.01	1.07	1.13	1.19	1.25	1.31	1.37	1.44	1.50	1.56	2.00
s w	1.29	1.37	1.46	1.54	1.04	2.13	2.21	2.31	2.40	2.48	2.55
sw by w	2.05	2.17	2.29	2.41	2.53	3.05	3.18	3.32	3.46	3.58	4.08
w s w	2.58	3.14	3.30	3.46	4.02	4.20	4.38	4.57	5.18		
w by s	4.16	4.36	4.56	5.17	5.39						
West	6.00										
☉ fet	6.00	5.56	5.51	5.47	5.42	5.37	5.33	5.28	5.23	5.19	5.16



A Sun-Dial for the Latitude of 25 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.19	0.17	0.16	0.14	0.12	0.10	0.08	0.06	0.04	0.02	0.01
s s w	0.40	0.36	0.32	0.29	0.25	0.21	0.17	0.13	0.09	0.05	0.03
sw by s	1.03	0.57	0.51	0.45	0.39	0.33	0.27	0.21	0.14	0.09	0.04
s w	1.32	1.23	1.15	1.06	0.57	0.49	0.40	0.31	0.21	0.13	0.06
sw by w	2.09	1.58	1.46	1.35	1.22	1.10	0.58	0.44	0.31	0.19	0.10
w s w	3.02	2.47	2.32	2.16	2.00	1.43	1.25	1.07	0.47	0.29	0.15
w by s	4.19	4.00	3.40	3.20	2.59	2.37	2.14	1.48	1.19	0.53	0.29
West	6.00	5.38	5.17	4.54	4.31	4.06	3.40	3.10	2.35	2.00	1.24
w by n					6.21	5.59	5.36	5.10	4.41	4.14	3.50
w n w										0.25	6.10
☉ fet	6.00	6.05	6.09	6.14	6.19	6.24	6.29	6.34	6.39	6.43	6.47
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	2.45	5.31	8.16	11.3	13.49	16.35	19.22	22.10	24.24	26.8

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.19	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.37
s s w	0.40	0.43	0.47	0.51	0.55	0.59	1.02	1.06	1.10	1.14	1.17
sw by s	1.03	1.09	1.15	1.21	1.27	1.33	1.39	1.46	1.52	1.58	2.02
s w	1.32	1.40	1.48	1.57	2.06	2.15	2.23	2.33	2.42	2.50	2.57
sw by w	2.09	2.21	2.32	2.44	2.56	3.08	3.21	3.34	3.48	4.00	4.09
w s w	3.02	3.18	3.33	3.49	4.05	4.22	4.39	4.58	5.19		
w by s	4.19	4.39	4.58	5.18	5.39						
West	6.00										
☉ fet	5.00	5.55	5.51	5.46	5.41	5.36	5.31	5.26	5.21	5.17	5.13



## A Sun-Dial for the Latitude of 26 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.07	0.05	0.03	0.02
s s w	0.41	0.38	0.34	0.30	0.26	0.23	0.19	0.15	0.11	0.07	0.04
sw by s	1.05	0.59	0.54	0.48	0.42	0.36	0.30	0.24	0.17	0.11	0.07
s w	1.35	1.26	1.18	1.10	1.01	0.51	0.43	0.34	0.25	0.17	0.11
sw by w	2.13	2.02	1.50	1.39	1.27	1.15	1.03	0.50	0.36	0.25	0.16
w s w	3.07	3.52	2.37	2.21	2.06	1.49	1.32	1.14	0.55	0.38	0.25
w by s	4.22	4.04	3.45	3.25	3.06	2.46	2.23	1.58	1.31	1.07	0.45
West	6.00	5.39	5.19	4.57	4.35	4.12	3.47	3.19	2.47	2.16	1.47
w b n					6.21	6.00	5.38	5.13	4.46	4.22	4.00
w n w									6.42	6.25	6.12
☉ set	6.00	6.05	6.10	6.15	6.20	6.25	6.30	6.35	6.41	6.45	6.49
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	2.46	5.33	8.21	11.8	13.56	16.44	19.33	22.22	24.37	26.23

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.20	0.20	0.24	0.25	0.27	0.29	0.31	0.33	0.35	0.36	0.38
s s w	0.41	0.45	0.49	0.52	0.56	1.00	1.04	1.08	1.12	1.15	1.18
sw by s	1.05	1.11	1.17	1.23	1.29	1.35	1.41	1.47	1.54	1.59	2.03
s w	1.35	1.43	1.51	2.00	2.08	2.17	2.26	2.35	2.44	2.52	2.59
sw by w	2.13	2.24	2.36	2.47	2.59	3.11	3.23	3.36	3.50	4.01	4.10
w s w	3.07	3.21	3.37	3.52	4.08	4.24	4.41	4.59	5.18		
w by s	4.22	4.41	5.00	5.19	5.39						
West	6.00										
☉ set	6.00	5.55	5.50	5.45	5.40	5.35	5.30	5.25	5.19	5.15	5.11



A Sun-Dial for the Latitude of 27 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.19	0.17	0.15	0.13	0.12	0.10	0.08	0.06	0.04	0.03
s s w	0.43	0.39	0.35	0.32	0.28	0.24	0.20	0.17	0.12	0.09	0.06
sw by s	1.07	1.02	0.56	0.50	0.45	0.39	0.33	0.27	0.20	0.13	0.10
s w	1.38	1.30	1.21	1.13	1.05	0.55	0.47	0.38	0.29	0.21	0.15
sw by w	2.17	2.06	1.55	1.43	1.32	1.20	1.08	0.55	0.42	0.32	0.23
w s w	3.10	2.56	2.41	2.26	2.11	1.55	1.39	1.22	1.03	0.47	0.34
w by s	4.25	4.07	3.49	3.31	3.11	2.51	2.31	2.07	1.42	1.19	0.59
West	6.00	5.40	5.21	5.00	4.39	4.17	3.53	3.27	2.58	2.30	2.05
w by n					6.21	6.01	5.39	5.17	4.51	4.28	4.09
w n w									6.42	6.26	6.13
☉ fet	6.00	6.05	6.10	6.15	6.21	6.26	6.31	6.37	6.43	6.48	6.51
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	2.48	5.37	8.25	11.14	14.03	16.53	19.43	22.34	24.51	26.37

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.22	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.37	0.38
s s w	0.43	0.46	0.50	0.53	0.57	1.01	1.05	1.09	1.13	1.16	1.19
sw by s	1.07	1.13	1.19	1.25	1.30	1.36	1.42	1.48	1.55	2.01	2.05
s w	1.38	1.46	1.54	2.02	2.11	2.19	2.28	2.37	2.46	2.54	3.00
sw by w	2.17	2.28	2.39	2.50	3.02	3.13	3.26	3.38	3.52	4.02	4.10
w s w	3.10	3.25	3.40	3.54	4.10	4.25	4.42	4.59	5.18		
w by s	4.25	4.43	5.02	5.20	5.39						
West	6.00										
☉ fet	6.00	5.55	5.50	5.45	5.39	5.34	5.29	5.23	5.17	5.12	5.09



## A Sun-Dial for the Latitude of 28 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.07	0.05	0.04
s s w	0.44	0.40	0.37	0.33	0.30	0.26	0.22	0.18	0.14	0.11	0.08
sw by s	1.10	1.04	0.58	0.53	0.47	0.41	0.35	0.29	0.22	0.16	0.13
s w	1.41	1.33	1.25	1.17	1.08	1.00	0.51	0.42	0.33	0.25	0.19
sw by w	2.20	2.10	1.59	1.48	1.36	1.25	1.13	1.01	0.48	0.37	0.28
w s w	3.14	3.00	2.46	2.31	2.17	2.01	1.45	1.28	1.11	0.55	0.43
w by s	4.28	4.11	3.53	3.36	3.17	2.58	2.38	2.16	1.52	1.31	1.13
West	6.00	5.41	5.22	5.03	4.43	4.21	3.59	3.35	3.07	2.42	2.20
w b n					6.21	6.02	5.41	5.20	4.56	4.34	4.16
w n w									6.42	6.27	6.14
☉ fet	6.00	6.05	6.11	6.16	6.22	6.27	6.33	6.39	6.45	6.50	6.53
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	2.50	5.40	8.30	11.21	14.11	17.3	19.54	22.48	25.6	26.52

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.38	0.39
s s w	0.44	0.48	0.51	0.55	0.58	1.02	1.06	1.10	1.14	1.17	1.20
sw by s	1.10	1.15	1.21	1.27	1.32	1.38	1.44	1.51	1.57	2.03	2.06
s w	1.41	1.49	1.57	2.05	2.13	2.21	2.30	2.39	2.47	2.56	3.02
sw by w	2.20	2.31	2.42	2.53	3.04	3.16	3.28	3.40	3.53	4.04	4.13
w s w	3.14	3.28	3.43	3.57	4.12	4.27	4.44	5.00	5.18		
w by s	4.28	4.45	5.03	5.21	5.39						
West	6.00										
☉ fet	6.00	5.55	5.49	5.44	5.38	5.33	5.27	5.21	5.15	5.10	5.07



A Sun-Dial for the Latitude of 29 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.22	0.20	0.19	0.17	0.15	0.13	0.11	0.10	0.08	0.06	0.05
s s w	0.45	0.42	0.38	0.35	0.31	0.27	0.23	0.19	0.16	0.12	0.10
sw by s	1.12	1.06	1.01	0.55	0.49	0.43	0.37	0.31	0.25	0.20	0.16
s w	1.43	1.36	1.28	1.20	1.12	1.03	0.55	0.46	0.37	0.29	0.23
sw by w	2.23	2.13	2.03	1.52	1.41	1.30	1.18	1.06	0.53	0.42	0.34
w s w	3.18	3.04	2.50	2.36	2.22	2.07	1.52	1.35	1.18	1.03	0.51
w by s	4.31	4.14	3.57	3.40	3.22	3.05	2.45	2.24	2.01	1.41	1.24
West	6.00	5.42	5.24	5.05	4.40	4.26	4.04	3.41	3.16	2.53	2.33
w by n					6.21	6.02	5.43	5.22	5.00	4.40	4.23
w n w									6.42	6.27	6.15
☉ fet	6.00	6.06	6.11	6.17	6.23	6.28	6.34	6.40	6.47	6.52	6.55
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d	d m	d m	d m	d m
	0.00	2.51	5.43	8.35	11.27	14.19	17.12	20.6	23.2	25.22	27.8

SOUTH DECLINATION

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.22	0.24	0.26	0.27	0.29	0.31	0.33	0.35	0.37	0.38	0.39
s s w	0.45	0.49	0.53	0.56	1.00	1.04	1.08	1.11	1.15	1.18	1.21
sw by s	1.12	1.17	1.23	1.29	1.34	1.40	1.46	1.52	1.59	2.04	2.08
s w	1.43	1.51	1.59	2.07	2.15	2.24	2.32	2.41	2.49	2.58	3.04
sw by w	2.23	2.34	2.45	2.56	3.07	3.18	3.30	3.42	3.55	4.05	4.14
w s w	3.18	3.32	3.46	4.00	4.14	4.29	4.44	5.00			
w by s	4.31	4.48	5.04	5.22	5.39						
West	6.00										
☉ fet	6.00	5.54	5.49	5.43	5.37	5.32	5.26	5.20	5.13	5.08	5.03



## A Sun-Dial for the Latitude of 30 Degrees.

## NORTH DECLINATION.

Deg. Min.	1 d	2 d	3 d	4 d	5 d	6 d	7 d	8 d	9 d	10 d	11 d	12 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.21	0.19	0.18	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.06
s s w	0.47	0.43	0.40	0.36	0.33	0.29	0.25	0.21	0.17	0.14	0.12	0.12
sw by s	1.14	1.08	1.03	0.98	0.92	0.86	0.80	0.74	0.68	0.62	0.56	0.50
s w	1.46	1.38	1.31	1.23	1.15	1.07	0.98	0.90	0.82	0.74	0.66	0.58
sw by w	2.27	2.17	2.06	1.95	1.84	1.73	1.62	1.51	1.40	1.29	1.18	1.07
w s w	3.21	3.08	2.55	2.41	2.27	2.13	1.98	1.84	1.70	1.56	1.42	1.28
w by s	4.33	4.17	4.01	3.84	3.67	3.50	3.33	3.16	2.99	2.82	2.65	2.48
West	5.00	5.43	5.25	5.07	4.49	4.30	4.09	3.48	3.24	3.02	2.44	2.44
w by n					6.21	6.03	5.45	5.25	5.03	4.45	4.29	4.29
w n w								6.42	6.28	6.17	6.17	6.17
☉ set	6.00	6.06	6.12	6.18	6.23	6.29	6.36	6.42	6.48	6.54	6.58	6.58
Sun's Ampl.	00.0	2.53	5.46	8.40	11.34	14.28	17.23	20.18	23.16	25.38	27.25	27.25

## SOUTH DECLINATION.

Deg. Min.	0 d	1 d	2 d	3 d	4 d	5 d	6 d	7 d	8 d	9 d	10 d	11 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.24	0.26	0.28	0.30	0.31	0.33	0.35	0.37	0.39	0.40	0.40
s s w	0.47	0.50	0.54	0.57	1.01	1.05	1.09	1.12	1.16	1.19	1.22	1.22
sw by s	1.14	1.19	1.25	1.30	1.36	1.42	1.48	1.54	2.00	2.05	2.09	2.09
s w	1.46	1.54	2.02	2.10	2.18	2.26	2.34	2.43	2.50	2.59	3.05	3.05
sw by w	2.27	2.38	2.48	2.58	3.09	3.20	3.32	3.44	3.56	4.06	4.14	4.14
w s w	3.21	3.35	3.48	4.02	4.16	4.30	4.45	5.01				
w by s	4.33	4.49	5.05	5.22	5.39							
West	6.00											
☉ set	6.00	5.54	5.48	5.42	5.37	5.31	5.24	5.18	5.12	5.06	5.02	5.02



A Sun-Dial for the Latitude of 31 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.22	0.20	0.18	0.17	0.15	0.13	0.11	0.09	0.08	0.07
s s w	0.48	0.45	0.41	0.38	0.34	0.31	0.27	0.23	0.19	0.16	0.13
sw by s	1.16	1.11	1.05	1.00	0.54	0.48	0.43	0.37	0.31	0.25	0.21
s w	1.49	1.41	1.34	1.26	1.18	1.10	1.02	0.53	0.45	0.37	0.32
sw by w	2.30	2.20	2.10	2.00	1.49	1.38	1.27	1.16	1.04	0.54	0.46
w s w	3.25	3.12	2.59	2.45	2.32	2.18	2.03	1.48	1.32	1.18	1.07
w by s	4.36	4.20	4.04	3.48	3.32	3.15	2.57	2.38	2.18	2.00	1.46
West	6.00	5.43	5.26	5.09	4.52	4.33	4.14	3.53	3.31	3.11	2.55
w by n					6.21	6.04	5.46	5.27	5.07	4.49	4.35
w n w									6.43	6.29	6.18
☉ set	6.00	6.06	6.12	6.18	6.24	6.31	6.37	6.44	6.51	6.56	7.01
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	2.55	5.50	8.46	11.41	14.37	17.34	20.31	23.31	25.55	27.43

SOUTH DECLINATION

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.38	0.39	0.40
s s w	0.48	0.52	0.55	0.59	1.02	1.05	1.10	1.13	1.17	1.20	1.23
sw by s	1.16	1.21	1.27	1.32	1.38	1.44	1.49	1.55	2.01	2.07	2.11
s w	1.49	1.57	2.04	2.12	2.20	2.28	2.36	2.45	2.52	3.01	3.06
sw by w	2.30	2.41	2.51	3.01	3.12	3.23	3.34	3.45	3.57	4.07	4.15
w s w	3.25	3.38	3.51	4.04	4.18	4.32	4.46	5.01			
w by s	4.36	4.50	5.07	5.23							
West	6.00										
☉ set	6.00	5.54	5.48	5.42	5.36	5.29	5.23	5.16	5.09	5.04	4.59



## A Sun-Dial for the Latitude of 32 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.24	0.22	0.21	0.19	0.17	0.16	0.14	0.12	0.10	0.09	0.07
s s w	0.50	0.46	0.43	0.39	0.36	0.32	0.29	0.25	0.21	0.18	0.15
sw by s	1.18	1.13	1.07	1.02	0.56	0.51	0.45	0.39	0.33	0.28	0.24
s w	1.52	1.44	1.37	1.29	1.22	1.14	1.05	0.57	0.49	0.41	0.36
w by w	2.34	2.24	2.14	2.04	1.54	1.43	1.32	1.21	1.09	0.59	0.51
w s w	3.28	3.15	3.03	2.50	2.37	2.23	2.09	1.54	1.39	1.25	1.15
w by s	4.38	4.23	4.08	3.52	3.37	3.20	3.03	2.45	2.26	2.09	1.55
West	5.00	5.44	5.28	5.11	4.55	4.37	4.19	3.59	3.38	3.19	3.04
w by n					6.21	6.05	5.48	5.30	5.10	4.53	4.39
n w								6.43	6.30	6.19	
☉ set	6.00	6.06	6.13	6.19	6.25	6.32	6.39	6.46	6.53	6.58	7.03
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	00.0	2.57	5.54	8.51	11.48	14.47	17.46	20.45	23.47	26.13	28.3

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.24	0.26	0.27	0.29	0.31	0.32	0.34	0.36	0.38	0.40	0.41
s s w	0.50	1.53	0.56	1.00	1.03	1.07	1.11	1.14	1.18	1.21	1.24
sw by s	1.18	1.23	1.29	1.34	1.40	1.45	1.50	2.57	2.03	2.08	2.12
s w	1.52	2.59	2.07	2.14	2.22	2.30	2.38	2.47	2.53	3.02	3.08
sw by w	2.34	2.44	2.54	3.04	3.14	3.25	3.35	3.47	3.59	4.08	4.16
w s w	3.28	3.41	3.53	4.06	4.19	4.33	4.47	5.02			
w by s	4.38	4.53	5.08	5.23							
West	6.00										
☉ set	6.00	5.54	5.47	5.41	5.35	5.28	5.21	5.14	5.07	5.02	4.57



## A Sun-Dial for the Latitude of 33 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.23	0.21	0.20	0.18	0.16	0.15	0.13	0.11	0.09	0.08
s s w	0.51	0.47	0.44	0.41	0.37	0.34	0.30	0.27	0.23	0.19	0.17
sw by s	1.20	1.15	1.09	1.04	0.59	0.53	0.48	0.42	0.36	0.31	0.27
s w	1.54	1.47	1.40	1.32	1.25	1.17	1.09	1.01	0.53	0.46	0.40
sw by w	2.37	2.27	2.17	2.07	1.57	1.47	1.36	1.25	1.14	1.04	0.57
w s w	3.31	3.19	3.06	2.54	2.41	2.28	2.14	2.00	1.45	1.32	1.22
w by s	4.40	4.25	4.11	3.56	3.41	3.25	3.09	2.51	2.33	2.17	2.04
West	6.00	5.45	5.29	5.13	4.57	4.40	4.23	4.04	3.44	3.26	3.12
w by n					6.21	6.05	5.49	5.32	5.13	4.57	4.44
w n w									6.43	6.30	6.20
☉ set	6.00	6.07	6.13	6.20	6.26	6.33	6.40	6.47	6.55	7.01	7.06
Sun's A mpl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	2.59	5.58	8.57	11.55	14.57	17.58	21.0	24.4	26.32	28.22

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.26	0.28	0.30	0.31	0.33	0.35	0.37	0.39	0.40	0.41
s s w	0.51	0.54	0.58	1.01	1.05	1.08	1.12	1.15	1.19	1.22	1.25
sw by s	1.20	1.25	1.30	1.36	1.41	1.47	1.52	1.58	2.04	2.09	2.13
s w	1.54	2.02	2.09	2.17	2.24	2.32	2.40	2.48	2.55	3.04	3.10
sw by w	2.37	2.46	2.56	3.06	3.16	3.27	3.37	3.48	4.00	4.09	4.17
w s w	3.31	3.43	3.56	4.08	4.21	4.34	4.48	5.02			
w by s	4.40	4.54	5.09	5.24							
West	6.00										
☉ set	6.00	5.53	5.47	5.40	5.34	5.27	5.20	5.13	5.05	4.59	4.54



## A Sun-Dial for the Latitude of 34 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.24	0.22	0.20	0.19	0.17	0.15	0.14	0.12	0.10	0.09
s s w	0.52	0.49	0.45	0.42	0.39	0.35	0.32	0.28	0.24	0.21	0.19
sw by s	1.22	1.17	1.12	1.07	1.01	0.56	0.50	0.44	0.38	0.34	0.30
s w	1.57	1.00	1.42	1.35	1.28	1.20	1.12	1.04	0.56	0.49	0.44
sw byw	2.40	2.30	2.21	2.11	2.01	1.51	1.41	1.30	1.19	1.09	1.02
w s w	3.34	3.22	3.10	2.58	2.45	2.33	2.19	2.06	1.51	1.39	1.29
w by s	4.42	4.28	4.14	3.59	3.45	3.30	3.14	2.57	2.40	2.24	2.12
West	6.00	5.45	5.30	5.15	5.00	4.43	4.26	4.09	3.49	3.33	3.19
w by n					6.21	6.06	5.50	5.34	5.16	5.01	4.49
w n w									6.43	6.31	6.21
☉ fet	6.00	6.07	6.14	6.20	6.27	6.34	6.42	6.49	6.57	7.03	7.08
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.08	6.02	9.03	12.3	15.8	18.11	21.16	24.22	26.52	28.45

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.27	0.29	0.30	0.32	0.34	0.35	0.37	0.39	0.41	0.42
s s w	0.52	0.55	0.59	1.02	1.06	1.09	1.13	1.16	1.20	1.23	1.26
sw by s	1.22	1.27	1.32	1.38	1.43	1.48	1.54	2.00	2.05	2.10	2.14
s w	1.57	2.04	2.11	2.19	2.26	2.34	2.42	2.50	2.57	3.05	3.10
sw byw	2.40	2.49	2.59	3.09	3.18	3.28	3.39	3.50	4.01	4.10	4.18
w s w	3.34	3.46	3.58	4.10	4.22	4.35	4.48	5.02			
w by s	4.42	4.56	5.10	5.24							
West	6.00										
☉ fet	6.00	5.53	5.46	5.40	5.33	5.26	5.18	5.11	5.03	4.57	4.52



A Sun-Dial for the Latitude of 35 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.26	0.24	0.23	0.21	0.19	0.18	0.16	0.14	0.13	0.11	0.10
s s w	0.53	0.50	0.47	0.44	0.40	0.37	0.33	0.30	0.26	0.23	0.20
sw by s	1.24	1.19	1.15	1.09	1.03	0.58	0.52	0.47	0.41	0.36	0.32
s w	1.49	1.52	1.44	1.38	1.31	1.23	1.15	1.08	0.59	0.53	0.47
sw by w	2.43	2.33	2.24	2.14	2.05	1.55	1.45	1.34	1.23	1.14	1.07
w s w	3.37	3.25	3.13	3.02	2.50	2.37	2.24	2.11	1.57	1.45	1.36
w by s	4.43	4.30	4.16	4.03	3.48	3.34	3.19	3.03	2.46	2.31	2.20
West	6.00	5.46	5.31	5.17	5.02	4.46	4.30	4.13	3.55	3.39	3.26
w by n					6.21	6.07	5.52	5.36	5.19	5.04	4.53
w n w									6.44	6.32	6.22
☉ fet	6.00	6.07	6.14	6.21	6.28	6.35	6.43	6.51	6.59	7.06	7.11
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.03	6.06	9.10	12.12	15.19	18.25	21.32	24.41	27.13	29.5

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.26	0.28	0.29	0.31	0.33	0.34	0.36	0.38	0.40	0.41	0.42
s s w	0.53	0.57	1.00	1.04	1.07	1.10	1.14	1.17	1.21	1.24	1.27
sw by s	1.24	1.29	1.34	1.39	1.45	1.50	1.55	2.01	2.07	2.12	2.15
s w	1.59	2.06	2.14	2.21	2.28	2.36	2.43	2.51	2.59	3.06	3.11
sw by w	2.43	2.52	3.01	3.11	3.20	3.30	3.40	3.51	4.02	4.11	4.18
w s w	3.37	3.48	4.00	4.12	4.24	4.36	4.49	5.02			
w by s	4.43	4.57	5.11	5.24							
West	6.00										
☉ fet	6.00	5.53	5.46	5.39	5.32	5.25	5.17	5.09	5.01	4.54	4.49



## A Sun-Dial for the Latitude of 36 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.25	0.23	0.22	0.20	0.19	0.17	0.15	0.13	0.12	0.11
s s w	0.55	0.51	0.48	0.45	0.42	0.38	0.35	0.31	0.28	0.24	0.22
sw by s	1.26	1.21	1.16	1.11	1.05	1.00	0.55	0.49	0.44	0.39	0.35
s w	2.02	1.55	1.48	1.41	1.34	1.26	1.19	1.11	1.03	0.56	0.51
sw by w	2.45	2.36	2.27	2.18	2.08	1.59	1.49	1.39	1.28	1.19	1.12
w s w	3.39	3.28	3.17	3.05	2.53	2.41	2.29	2.16	2.03	1.51	1.42
w by s	4.45	4.32	4.19	4.06	3.52	3.38	3.23	3.08	2.52	2.38	2.27
West	6.00	5.46	5.32	5.18	5.04	4.49	4.33	4.17	4.00	3.45	3.33
w by n					6.22	6.08	5.53	5.38	5.22	5.08	4.57
w n w									6.44	6.33	6.24
☉ fet	6.00	5.07	6.15	6.22	6.29	6.37	6.45	6.53	7.01	7.08	7.14
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.06	6.11	9.17	12.24	15.31	18.40	21.49	25.0	27.35	29.32

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.28	0.30	0.31	0.33	0.35	0.36	0.38	0.40	0.41	0.43
s s w	0.55	0.58	1.01	1.05	1.08	1.11	1.15	1.18	1.22	1.25	1.27
sw by s	1.26	1.31	1.36	1.41	1.46	1.51	1.57	2.02	2.08	2.13	2.16
s w	2.02	2.09	2.16	2.23	2.30	2.37	2.45	2.53	3.01	3.07	3.12
sw by w	2.45	2.54	3.04	3.13	3.22	3.32	3.42	3.52	4.03	4.12	4.18
w s w	3.39	3.51	4.02	4.13	4.25	4.37	4.49	5.02			
w by s	4.45	4.58	5.11	5.25							
West	6.00										
☉ fet	6.00	5.53	5.45	5.38	5.31	5.23	5.15	5.07	4.59	4.52	4.46



A Sun-Dial for the Latitude of 37 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	30m h m	h m	30m h m	h m	30m h m	h m	30m h m	h m	h m	29m h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.26	0.24	0.23	0.21	0.19	0.18	0.16	0.14	0.13	0.12
s s w	0.56	0.53	0.50	0.46	0.43	0.40	0.36	0.33	0.29	0.26	0.24
sw by s	1.28	1.23	1.18	1.13	1.08	1.02	0.57	0.52	0.47	0.41	0.38
s w	2.04	1.57	1.50	1.43	1.36	1.29	1.22	1.14	1.07	1.00	0.55
sw by w	2.48	2.39	2.30	2.21	2.12	2.03	1.53	1.43	1.33	1.24	1.17
w s w	3.42	3.31	3.20	3.09	2.57	2.46	2.34	2.21	2.08	1.57	1.48
w by s	4.47	4.34	4.21	4.09	3.56	3.42	3.28	3.13	2.58	2.45	2.34
West	6.00	5.47	5.33	5.19	5.06	4.52	4.37	4.21	4.05	3.50	3.39
w by n					6.22	6.08	5.54	5.40	5.24	5.11	5.00
w n w									6.44	6.33	6.25
☉ fet	6.00	6.08	6.15	6.23	6.31	6.39	6.47	6.55	7.04	7.11	7.17
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.08	6.16	9.25	12.32	15.44	18.55	22.8	25.21	27.58	29.58

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	30m h m	h m	30m h m	h m	30m h m	h m	30m h m	h m	h m	29m h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.29	0.31	0.32	0.34	0.35	0.37	0.39	0.41	0.42	0.43
s s w	0.56	0.59	1.02	1.06	1.09	1.12	1.16	1.19	1.23	1.26	1.28
sw by s	1.28	1.33	1.37	1.42	1.47	1.53	1.58	2.04	2.09	2.14	2.17
s w	2.04	2.11	2.18	2.25	2.32	2.39	2.46	2.54	3.02	3.08	3.13
sw by w	2.48	2.57	3.06	3.15	3.24	3.33	3.43	3.53	4.03	4.12	4.19
w s w	3.42	3.53	4.04	4.15	4.26	4.38	4.50	5.02			
w by s	4.47	5.00	5.12	5.25							
West	6.00										
☉ fet	6.00	5.52	5.45	5.37	5.29	5.21	5.13	5.05	4.56	4.49	4.43



## A Sun-Dial for the Latitude of 38 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	29m
		30m		30m		30m		30m			h m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	23 d
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.28	0.26	0.25	0.23	0.21	0.20	0.18	0.17	0.15	0.13	0.12
s s w	0.57	0.54	0.51	0.48	0.45	0.41	0.38	0.34	0.31	0.28	0.26
sw by s	1.29	1.24	1.20	1.15	1.10	1.05	1.00	0.54	0.49	0.44	0.41
s w	2.06	2.00	1.53	1.46	1.39	1.32	1.25	1.18	1.10	1.04	0.59
sw by w	2.51	2.42	2.33	2.24	2.15	2.06	1.57	1.47	1.37	1.29	1.22
w s w	3.44	3.34	3.23	3.12	3.01	2.50	2.39	2.26	2.13	2.03	1.54
w by s	4.48	4.36	4.24	4.12	4.00	3.46	3.33	3.18	3.03	2.50	2.40
West	6.00	5.47	5.34	5.21	5.08	4.54	4.41	4.25	4.09	3.55	3.45
w by n					6.22	6.09	5.56	5.41	5.26	5.14	5.04
w n w									6.45	6.34	6.26
☉ fet	6.00	6.08	6.16	6.24	6.32	6.40	6.48	6.57	7.06	7.14	7.19
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	00.0	3.10	6.21	9.32	12.43	15.56	19.11	22.26	25.43	28.23	30.24

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.28	0.30	0.31	0.33	0.34	0.36	0.38	0.39	0.41	0.42	0.44
s s w	0.57	1.00	1.04	1.07	1.10	1.13	1.16	1.20	1.24	1.27	1.29
sw by s	1.29	1.34	1.39	1.44	1.49	1.54	1.59	2.05	2.10	2.15	2.18
s w	2.06	2.13	2.20	2.27	2.34	2.41	2.48	2.55	3.03	3.09	3.14
sw by w	2.51	2.59	3.08	3.17	3.26	3.35	3.44	3.54	4.04	4.13	4.19
w s w	3.44	3.55	4.06	4.17	4.28	4.39	4.50	5.02			
w by s	4.48	5.00	5.13	5.25							
West	6.00										
☉ fet	6.00	5.52	5.44	5.36	5.28	5.20	5.12	5.03	4.54	4.46	4.41



A Sun-Dial for the Latitude of 39 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.27	0.25	0.24	0.22	0.21	0.19	0.17	0.16	0.14	0.13
s s w	0.58	0.55	0.52	0.49	0.46	0.43	0.39	0.36	0.32	0.30	0.27
sw by s	1.31	1.26	1.22	1.17	1.12	1.07	1.02	0.57	0.51	0.47	0.43
s w	2.09	2.02	1.55	1.49	1.42	1.35	1.28	1.21	1.13	1.07	1.02
sw by w	2.53	2.45	2.36	2.27	2.19	2.10	2.01	1.51	1.41	1.33	1.27
w s w	3.47	3.36	3.26	3.15	3.05	2.54	2.42	2.31	2.18	2.08	2.00
w by s	4.50	4.38	4.26	4.14	4.02	3.49	3.36	3. 3	3.08	2.56	2.47
West	6.00	5.48	5.35	5.22	5.10	4.56	4.43	4.28	4.13	4.00	3.50
w by n					6.22	6.10	5.57	5.43	5.29	5.16	5.07
w n w									6.45	6.35	6.27
☉ fet	6.00	6.08	6.16	6.24	6.32	6.41	6.50	6.59	7.09	7.16	7.22
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.13	6.26	9.40	12.54	16.10	19.28	22.45	26.06	28.49	30.52

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.30	0.32	0.33	0.35	0.36	0.38	0.40	0.41	0.43	0.44
s s w	0.58	1.02	1.05	1.08	1.11	1.14	1.18	1.21	1.25	1.27	1.30
sw by s	1.31	1.36	1.41	1.46	1.51	1.56	2.01	2.06	2.11	2.16	2.19
s w	2.09	2.15	2.22	2.29	2.35	2.42	2.49	2.57	3.04	3.10	3.15
sw by w	2.53	3.02	3.10	3.19	3.27	3.36	3.46	3.55	4.05	4.13	4.20
w s w	3.47	3.57	4.08	4.18	4.29	4.39	4.51	5.03			
w by s	4.50	5.02	5.14	5.26							
West	6.00										
☉ fet	6.00	5.52	5.44	5.36	5.28	5.19	5.10	5.01	4.51	4.44	4.38



## A Sun-Dial for the Latitude of 40 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	29 m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.28	0.26	0.24	0.23	0.21	0.20	0.18	0.17	0.15	0.14
s s w	1.00	0.57	0.53	0.50	0.47	0.44	0.41	0.37	0.34	0.31	0.29
sw by s	1.33	1.28	1.24	1.19	1.14	1.09	1.04	0.59	0.54	0.49	0.46
s w	2.11	2.04	1.58	1.51	1.45	1.38	1.31	1.24	1.17	1.11	1.06
sw by w	2.56	2.47	2.39	2.30	2.22	2.14	2.04	1.55	1.46	1.38	1.31
w s w	3.49	3.39	3.29	3.18	3.08	2.58	2.46	2.35	2.23	2.13	2.05
w by s	4.51	4.40	4.28	4.17	4.05	3.53	3.40	3.27	3.13	3.02	2.52
West	6.00	5.48	5.36	5.23	5.11	4.59	4.46	4.32	4.17	4.01	3.55
w by n					6.22	6.11	5.58	5.45	5.38	5.19	5.10
w n w								6.58	6.46	6.36	6.28
☉ fet	6.00	6.08	6.17	6.25	6.34	6.43	6.52	7.01	7.11	7.19	7.25
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	00.0	3.15	6.32	9.48	13.6	16.24	19.45	23.06	26.30	29.16	31.22

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.42	0.43	0.44
s s w	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.22	1.25	1.28	1.30
sw by s	1.33	1.38	1.43	1.47	1.52	1.57	2.02	2.07	2.12	2.17	2.20
s w	2.11	2.17	2.24	2.31	2.37	2.44	2.51	2.58	3.05	3.11	3.16
sw by w	2.56	3.04	3.12	3.21	3.29	3.38	3.47	3.56	4.06	4.14	4.20
w s w	3.49	3.59	4.09	4.19	4.30	4.40	4.51	5.03			
w by s	4.51	5.03	5.14	5.26							
West	6.00										
☉ fet	6.00	5.52	5.43	5.35	5.26	5.17	5.08	4.59	4.49	4.41	4.35



## A Sun-Dial for the Latitude of 41 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.28	0.27	0.25	0.24	0.22	0.21	0.19	0.17	0.16	0.15
s s w	1.01	0.58	0.55	0.52	0.49	0.46	0.42	0.39	0.36	0.33	0.31
sw by s	1.35	1.30	1.25	1.21	1.16	1.11	1.06	1.01	0.56	0.52	0.48
s w	2.13	2.07	2.00	1.54	1.48	1.41	1.34	1.27	1.20	1.14	1.09
sw by w	2.58	2.50	2.42	2.33	2.25	2.17	2.08	1.59	1.50	1.42	1.36
w s w	3.51	3.41	3.31	3.21	3.11	3.01	2.50	2.39	2.28	2.18	2.11
w by s	4.53	4.42	4.30	4.19	4.08	3.57	3.44	3.31	3.18	3.07	2.58
West	6.00	5.48	5.36	5.25	5.13	5.01	4.48	4.35	4.21	4.09	4.00
w by n					6.23	6.12	5.59	5.46	5.33	5.22	5.13
w n w								6.58	6.46	6.37	6.29
☉ fet	6.00	6.09	6.17	6.26	6.35	6.44	6.54	7.04	7.14	7.22	7.29
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.18	6.38	9.57	13.18	16.40	20.4	23.29	26.56	29.45	31.54

## SOUTH DECLINATION

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.44	0.45
s s w	1.01	1.04	1.07	1.10	1.13	1.16	1.19	1.23	1.26	1.29	1.31
sw by s	1.35	1.39	1.44	1.49	1.53	1.58	2.03	2.08	2.13	2.18	2.21
s w	2.13	2.19	2.26	2.32	2.39	2.45	2.52	2.59	3.06	3.12	3.17
sw by w	2.58	3.06	3.14	3.22	3.31	3.39	3.48	3.57	4.06	4.14	4.20
w s w	3.51	4.01	4.11	4.21	4.30	4.40	4.51	5.03			
w by s	4.53	5.04	5.15	5.26							
West	6.00										
☉ fet	6.00	5.51	5.43	5.34	5.25	5.16	5.06	4.56	4.46	4.38	4.31



## A Sun-Dial for the Latitude of 42 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.18	0.17	0.16
s s w	1.02	0.59	0.56	0.53	0.50	0.47	0.44	0.41	0.37	0.34	0.32
sw by s	1.36	1.32	1.27	1.23	1.18	1.13	1.09	1.04	0.58	0.54	0.51
s w	2.15	2.09	2.03	1.56	1.50	1.44	1.37	1.30	1.23	1.17	1.13
sw by w	3.00	2.52	2.44	2.36	2.28	2.20	2.12	2.03	1.54	1.46	1.40
w s w	3.53	3.43	3.34	3.24	3.15	3.05	2.54	2.44	2.33	2.23	2.16
w by s	4.54	4.43	4.32	4.21	4.10	4.00	3.48	3.36	3.23	3.12	3.03
West	6.00	5.49	5.37	5.26	5.15	5.03	4.51	4.39	4.24	4.13	4.04
w by n					6.23	6.12	6.00	5.48	5.35	5.24	5.16
w n w								6.58	6.47	6.37	6.30
☉ fet	6.00	6.09	6.18	6.27	6.37	6.46	6.56	7.06	7.17	7.25	7.32
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	00.0	3.21	6.44	10.6	13.31	16.56	20.23	23.52	27.24	30.16	32.28

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.32	0.33	0.35	0.36	0.38	0.39	0.41	0.43	0.44	0.45
s s w	1.02	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.27	1.30	1.32
sw by s	1.36	1.41	1.46	1.50	1.55	1.59	2.04	2.09	2.14	2.19	2.22
s w	2.15	2.21	2.28	2.34	2.40	2.46	2.53	3.00	3.07	3.13	3.17
sw by w	3.00	3.08	3.16	3.24	3.32	3.40	3.49	3.57	4.07	4.14	4.20
w s w	3.53	4.02	4.12	4.22	4.31	4.41	4.52				
w by s	4.54	5.04	5.15	5.26							
West	6.00										
☉ fet	6.00	5.51	5.42	5.33	5.23	5.14	5.04	4.54	4.43	4.35	4.28



A Sun-Dial for the Latitude of 43 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.29	0.28	0.27	0.25	0.24	0.22	0.21	0.19	0.18	0.17
s s w	1.03	1.00	0.57	0.54	0.51	0.48	0.45	0.42	0.39	0.36	0.34
sw by s	1.38	1.34	1.29	1.25	1.20	1.15	1.11	1.06	1.01	0.57	0.53
s w	2.17	2.11	2.05	1.59	1.53	1.47	1.40	1.33	1.26	1.20	1.16
sw by w	3.02	2.55	2.47	2.39	2.31	2.23	2.15	2.07	1.58	1.50	1.44
w s w	3.55	3.46	3.36	3.27	3.18	3.08	2.58	2.48	2.37	2.28	2.21
w by s	4.55	4.45	4.34	4.23	4.13	4.03	3.52	3.40	3.27	3.17	3.09
West	6.00	5.49	5.38	5.27	5.16	5.05	4.53	4.41	4.27	4.17	4.09
w by n					6.23	6.13	6.01	5.50	5.37	5.27	5.19
w n w								6.58	6.47	6.38	6.31
☉ set	6.00	6.09	6.19	6.28	6.38	6.48	6.58	7.09	7.19	7.28	7.36
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.25	6.51	10.17	13.44	17.13	20.43	24.16	27.53	30.48	33.03

SOUTH DECLINATION

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			2
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.41	0.43	0.44	0.45
s s w	1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27	1.30	1.32
sw by s	1.38	1.42	1.47	1.52	1.56	2.01	2.05	2.10	2.15	2.19	2.23
s w	2.17	2.23	2.29	2.36	2.42	2.48	2.54	3.01	3.08	3.14	3.18
sw by w	3.02	3.10	3.18	3.26	3.33	3.41	3.50	3.58	4.07	4.14	4.20
w s w	3.55	4.04	4.14	4.23	4.32	4.42	4.52				
w by s	4.55	5.05	5.16	5.26							
West	6.00										
☉ set	6.00	5.51	5.41	5.32	5.22	5.12	5.02	4.51	4.41	4.32	4.24



## A Sun-Dial for the Latitude of 44 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.18	0.17
s s w	1.04	1.01	0.58	0.56	0.53	0.50	0.47	0.44	0.40	0.38	0.36
sw by s	1.40	1.35	1.31	1.27	1.22	1.18	1.13	1.08	1.03	0.59	0.56
s w	2.19	2.13	2.07	2.01	1.55	1.49	1.43	1.36	1.29	1.24	1.20
sw by w	3.04	2.57	2.49	2.42	2.34	2.26	2.18	2.10	2.01	1.54	1.49
w s w	3.57	3.48	3.38	3.29	3.21	3.12	3.02	2.52	2.41	2.33	2.26
w by s	4.56	4.46	4.36	4.26	4.16	4.05	3.54	3.43	3.31	3.21	3.13
West	6.00	5.50	5.39	5.28	5.18	5.07	4.56	4.44	4.31	4.21	4.13
w by n					6.23	6.13	6.02	5.51	5.39	5.29	5.21
w n w								6.59	6.48	6.39	6.32
☉ fet	6.00	6.10	6.19	6.29	6.39	6.49	7.00	7.11	7.22	7.31	7.39
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	00.0	3.28	6.58	10.27	13.58	17.30	21.5	24.42	28.23	31.22	33.40

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.46
s s w	1.04	1.07	1.10	1.13	1.16	1.19	1.22	1.25	1.28	1.31	1.33
sw by s	1.40	1.44	1.48	1.53	1.57	2.02	2.06	2.11	2.16	2.20	2.23
s w	2.19	2.25	2.31	2.37	2.43	2.49	2.56	3.02	3.09	3.14	3.19
sw by w	3.04	3.12	3.19	3.27	3.35	3.42	3.51	3.59	4.08	4.15	4.20
w s w	3.57	4.06	4.15	4.24	4.33	4.42	4.52				
w by s	4.56	5.06	5.16	5.26							
West	6.00										
☉ fet	6.00	5.50	5.14	5.31	5.21	5.11	5.00	4.49	4.38	4.29	4.21



A Sun-Dial for the Latitude of 45 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.22	0.20	0.19	0.18
s s w	1.05	1.03	1.00	0.57	0.54	0.51	0.48	0.45	0.42	0.39	0.37
sw by s	1.41	1.37	1.33	1.28	1.24	1.19	1.15	1.10	1.05	1.01	0.58
s w	2.21	2.15	2.09	2.03	1.58	1.52	1.45	1.39	1.33	1.27	1.23
sw by w	3.06	2.59	2.52	2.45	2.37	2.29	2.22	2.13	2.05	1.58	1.53
w s w	3.59	3.50	3.41	3.32	3.23	3.14	3.05	2.55	2.45	2.37	2.30
w by s	4.57	4.47	4.38	4.28	4.18	4.08	3.57	3.46	3.35	3.26	3.18
West	6.00	5.50	5.40	5.30	5.19	5.09	4.58	4.46	4.35	4.25	4.17
w by n					6.24	6.14	6.03	5.52	5.41	5.31	5.24
w n w								6.59	6.48	6.40	6.33
nw by w											7.40
☉ fet	6.00	6.10	6.20	6.30	6.41	6.51	7.02	7.13	7.25	7.35	7.43
Sun's Ampl.	d m	d m	d m	d m	d	d m	d m	d m	d m	d m	d m
	0.00	3.32	7.05	10.38	14.13	17.49	21.28	25.09	28.56	31.58	34.20

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.32	0.33	0.35	0.36	0.38	0.39	0.41	0.42	0.44	0.45	0.46
s s w	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.31	1.33
sw by s	1.41	1.45	1.50	1.54	1.58	2.03	2.07	2.12	2.17	2.21	2.24
s w	2.21	2.27	2.33	2.39	2.44	2.51	2.57	3.03	3.10	3.15	3.19
sw by w	3.06	3.14	3.21	3.28	3.36	3.44	3.51	4.00	4.08	4.15	
w s w	3.59	4.07	4.16	4.25	4.34	4.43	4.52				
w by s	4.57	5.07	5.17	5.26							
West	6.00										
☉ fet	6.00	5.50	5.40	5.30	5.19	5.09	4.58	4.47	4.35	4.25	4.17



## A Sun-Dial for the Latitude of 46 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.31	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.19
s s w	1.06	1.04	1.01	0.58	0.55	0.52	0.49	0.46	0.43	0.41	0.39
sw by s	1.43	1.38	1.34	1.30	1.26	1.21	1.17	1.12	1.08	1.04	1.01
s w	2.23	2.17	2.11	2.06	2.00	1.54	1.48	1.42	1.36	1.30	1.26
sw by w	3.08	3.01	2.54	2.47	2.40	2.32	2.25	2.17	2.09	2.02	1.57
w s w	4.00	3.52	3.43	3.35	3.26	3.17	3.08	2.59	2.49	2.41	2.35
w by s	5.58	4.49	4.39	4.30	4.20	4.11	4.00	3.50	3.39	3.30	3.23
West	6.00	5.50	5.40	5.30	5.20	5.11	5.00	4.49	4.38	4.28	4.21
w b n					6.24	6.14	6.04	5.54	5.43	5.33	5.26
w n w								0.59	6.49	6.41	6.34
nw byw											7.40
☉ set	6.00	6.10	6.21	6.31	6.42	6.53	7.04	7.16	7.29	7.39	7.47
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.36	7.12	10.50	14.28	18.9	21.52	25.39	29.31	32.37	35.3

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.34	0.35	0.37	0.38	0.40	0.41	0.42	0.44	0.45	0.46
s s w	1.06	1.09	1.12	1.15	1.18	1.20	1.23	1.26	1.29	1.32	1.34
sw by s	1.43	1.47	1.51	1.55	2.00	2.04	2.08	2.13	2.18	2.22	2.25
s w	2.23	2.29	2.34	2.40	2.46	2.52	2.58	3.04	3.10	3.16	3.20
sw by w	3.08	3.16	3.23	3.30	3.37	3.45	3.52	4.00	4.08	4.15	
w s w	4.00	4.09	4.17	4.26	4.34	4.43					
w by s	4.58	5.08	5.17	5.26							
West	6.00										
☉ set	6.00	5.50	5.39	5.29	5.18	5.07	4.56	4.44	4.31	4.21	4.13



A Sun-Dial for the Latitude of 47 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.32	0.30	0.29	0.28	0.26	0.25	0.23	0.22	0.21	0.20
s s w	1.07	1.05	1.02	0.59	0.56	0.54	0.51	0.48	0.45	0.42	0.40
sw by s	1.44	1.40	1.36	1.32	1.28	1.23	1.19	1.15	1.10	1.06	1.03
s w	2.25	2.19	2.14	2.08	2.02	1.57	1.51	1.45	1.39	1.33	1.29
sw by w	3.10	3.03	2.56	2.49	2.43	2.35	2.28	2.20	2.13	2.06	2.01
w s w	4.02	3.54	3.46	3.37	3.29	3.20	3.12	3.03	2.53	2.45	2.39
w by s	4.59	4.50	4.41	4.32	4.23	4.13	4.03	3.53	3.43	3.34	3.27
West	6.00	5.51	5.41	5.32	5.22	5.12	5.02	4.52	4.41	4.31	4.24
w by n				6.34	6.25	6.15	6.05	5.55	5.44	5.36	5.29
w n w							7.08	6.59	6.49	6.41	6.35
nw by w											7.40
☉ fet	6.00	6.11	6.22	6.33	6.43	6.55	7.07	7.20	7.32	7.43	7.51
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.40	7.20	11.2	14.44	18.30	22.18	26.10	30.7	33.18	35.48

SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.34	0.36	0.37	0.38	0.40	0.41	0.43	0.44	0.45	0.46
s s w	1.07	1.10	1.13	1.16	1.18	1.21	1.24	1.27	1.30	1.32	1.34
sw by s	1.44	1.48	1.52	1.57	2.01	2.05	2.09	2.14	2.18	2.22	2.25
s w	2.25	2.30	2.36	2.41	2.47	2.53	2.59	3.05	3.11	3.16	3.20
sw by w	3.10	3.17	3.24	3.31	3.38	3.45	3.53	4.00	4.08	4.15	
w s w	4.02	4.10	4.18	4.26	4.35	4.43					
w by s	4.59	5.08	5.17								
West	6.00										
☉ fet	6.00	5.49	5.38	5.27	5.17	5.05	4.53	4.40	4.28	4.13	4.09



## A Sun-Dial for the Latitude of 48 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.32	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21
s s w	1.08	1.06	1.03	1.00	0.58	0.55	0.52	0.49	0.46	0.44	0.42
<sup>s</sup> w by s	1.46	1.42	1.38	1.34	1.30	1.25	1.21	1.17	1.12	1.08	1.05
s w	2.27	2.21	2.16	2.10	2.05	1.59	1.53	1.47	1.41	1.36	1.32
sw by w	3.12	3.06	2.59	2.52	2.46	2.38	2.31	2.23	2.16	2.09	2.04
w s w	4.03	3.56	3.48	3.40	3.32	3.23	3.15	3.06	2.57	2.49	2.43
w by s	5.00	4.51	4.43	4.34	4.25	4.16	4.06	3.56	3.46	3.38	3.31
West	6.00	5.51	5.42	5.33	5.23	5.14	5.04	4.54	4.43	4.35	4.28
w b n				6.34	6.25	6.16	6.06	5.56	5.46	5.38	5.31
w n w							7.08	6.59	6.50	6.42	6.36
nw by w										7.45	7.40
☉ set	6.00	6.11	6.22	6.33	6.45	6.57	7.09	7.22	7.35	7.47	7.56
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.44	7.29	11.15	15.2	18.52	22.45	26.43	30.45	34.3	36.35

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.35	0.36	0.38	0.39	0.40	0.42	0.43	0.45	0.46	0.47
s s w	1.08	1.11	1.14	1.16	1.19	1.22	1.25	1.28	1.31	1.33	1.35
sw by s	1.46	1.50	1.54	1.58	2.02	2.06	2.10	2.15	2.19	2.23	2.26
s w	2.27	2.32	2.37	2.43	2.48	2.54	3.00	3.05	3.12	3.17	3.21
sw by w	3.12	3.19	3.26	3.32	3.39	3.45	3.53	4.01	4.09		
w s w	4.03	4.11	4.19	4.27	4.35	4.44					
w by s	5.00	5.09	5.17	5.26							
West	6.00										
☉ set	6.00	5.49	5.38	5.27	5.15	5.03	4.51	4.38	4.25	4.13	4.04



A Sun-Dial for the Latitude of 49 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.33	0.32	0.30	0.29	0.28	0.26	0.25	0.23	0.22	0.21
s s w	1.09	1.07	1.04	1.02	0.59	0.56	0.53	0.51	0.48	0.45	0.43
sw by s	1.47	1.43	1.39	1.35	1.31	1.27	1.23	1.19	1.14	1.11	1.08
s w	2.28	2.23	2.18	2.12	2.07	2.01	1.56	1.50	1.44	1.39	1.35
sw by w	3.14	3.07	3.01	2.54	2.48	2.41	2.34	2.27	2.19	2.13	2.08
w s w	4.05	3.57	3.50	3.42	3.34	3.26	3.18	3.09	3.00	2.53	2.47
w by s	5.01	4.53	4.44	4.36	4.27	4.18	4.09	4.00	3.50	3.42	3.35
West	6.00	5.51	5.42	5.34	5.25	5.16	5.06	4.56	4.46	4.38	4.31
w by n				6.34	6.25	6.16	6.07	5.58	5.48	5.40	5.33
w n w							7.08	7.00	6.51	6.43	6.38
nw byw										7.45	7.40
☉ fet	6.00	6.11	6.23	6.34	6.47	6.59	7.12	7.25	7.39	7.51	8.00
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.18	7.38	11.28	15.21	19.15	23.14	27.17	31.25	34.48	37.26

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.35	0.37	0.38	0.39	0.41	0.42	0.43	0.45	0.46	0.47
s s w	1.09	1.12	1.15	1.17	1.20	1.23	1.25	1.28	1.31	1.33	1.35
sw by s	1.47	1.51	1.55	1.59	2.03	2.07	2.11	2.15	2.20	2.23	2.26
s w	2.28	2.33	2.39	2.44	2.49	2.55	3.00	3.06	3.12	3.17	3.21
sw by w	3.14	3.20	3.27	3.34	3.40	3.47	3.54	4.01	4.09		
w s w	4.05	4.13	4.20	4.28	4.36	4.44					
w by s	5.01	5.09	5.18								
West	6.00										
☉ fet	6.00	5.49	5.37	5.26	5.13	5.01	4.48	4.35	4.21	4.09	4.00



## A Sun-Dial for the Latitude of 50 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22
s s w	1.10	1.08	1.05	1.03	1.00	0.58	0.55	0.52	0.49	0.47	0.45
sw by s	1.48	1.45	1.41	1.37	1.33	1.29	1.25	1.21	1.16	1.13	1.10
s w	2.30	2.25	2.20	2.15	2.09	2.04	1.58	1.53	1.47	1.42	1.38
sw by w	3.16	3.09	3.03	2.56	2.50	2.43	2.36	2.30	2.23	2.16	2.12
w s w	4.06	3.59	3.51	3.44	3.36	3.29	3.21	3.13	3.04	2.57	2.51
w by s	5.02	4.54	4.45	4.37	4.29	4.20	4.12	4.03	3.53	3.45	3.39
West	6.00	5.52	5.43	5.34	5.26	5.17	5.08	4.59	4.49	4.41	4.34
w by n				6.34	6.25	6.17	6.08	5.59	5.49	5.42	5.36
w n w							7.08	7.00	6.51	6.44	6.39
nw byw										7.45	7.41
set	6.00	6.12	6.24	6.36	6.49	7.01	7.14	7.28	7.43	7.55	8.05
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	00.0	3.53	7.48	11.42	15.40	19.40	23.45	27.53	32.8	35.37	38.20

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.36	0.37	0.38	0.40	0.41	0.42	0.44	0.45	0.46	0.47
s s w	1.10	1.13	1.15	1.18	1.21	1.23	1.26	1.29	1.32	1.34	1.36
sw by s	1.48	1.52	1.56	2.00	2.04	2.08	2.12	2.16	2.20	2.24	2.27
s w	2.30	2.35	2.40	2.45	2.50	2.56	3.01	3.07	3.13	3.17	3.21
sw by w	3.16	3.22	3.28	3.35	3.41	3.48	3.55	4.02	4.09		
w s w	4.06	4.14	4.21	4.29	4.36	4.44					
w by s	5.02	5.10	5.18								
West	6.00										
☉ set	6.00	5.48	5.36	5.24	5.11	4.59	4.46	4.32	4.17	4.05	3.55



A Sun-Dial for the Latitude of 51 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.26	0.25	0.24	0.23
s s w	1.11	1.09	1.06	1.04	1.01	0.59	0.56	0.53	0.51	0.48	0.47
sw by s	1.50	1.46	1.42	1.39	1.35	1.31	1.27	1.23	1.19	1.15	1.12
s w	2.31	2.26	2.21	2.16	2.11	2.06	2.01	1.55	1.50	1.45	1.41
sw by w	3.17	3.11	3.05	2.59	2.52	2.46	2.39	2.33	2.26	2.20	2.15
w s w	4.08	4.01	3.53	3.46	3.39	3.31	3.24	3.16	3.08	3.01	2.55
w by s	5.03	4.55	4.47	4.39	4.31	4.22	4.14	4.05	3.56	3.49	3.43
West	6.00	5.52	5.44	5.35	5.27	5.18	5.10	5.01	4.52	4.44	4.37
w by n				6.34	6.26	6.17	6.09	6.00	5.51	5.44	5.38
w n w							7.08	7.00	6.52	6.45	6.40
nw byw										7.45	7.41
☉ fet	6.00	6.12	6.25	6.38	6.50	7.03	7.17	7.32	7.47	8.00	8.10
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	3.58	7.58	11.57	16.1	20.8	24.18	28.33	32.54	36.30	39.19

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.36	0.38	0.39	0.40	0.41	0.42	0.44	0.46	0.47	0.48
s s w	1.11	1.14	1.16	1.19	1.21	1.24	1.27	1.29	1.32	1.34	1.36
sw by s	1.50	1.53	1.57	2.01	2.05	2.09	2.13	2.17	2.21	2.24	2.27
s w	2.31	2.36	2.41	2.46	2.52	2.57	3.02	3.07	3.13	3.18	3.21
sw by w	3.17	3.23	3.30	3.36	3.42	3.49	3.55	4.02	4.09		
w s w	4.08	4.15	4.22	4.29	4.37	4.44					
w by s	5.03	5.10	5.18								
West	6.00										
☉ fet	6.00	5.48	5.35	5.22	5.10	4.57	4.43	4.28	4.13	4.00	3.50



## A Sun-Dial for the Latitude of 52 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.34	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.25	0.24
s s w	1.12	1.10	1.08	1.05	1.03	1.00	0.57	0.55	0.52	0.50	0.48
sw by s	1.51	1.47	1.44	1.40	1.36	1.33	1.29	1.25	1.21	1.17	1.15
s w	2.33	2.28	2.23	2.18	2.13	2.08	2.03	1.58	1.52	1.48	1.44
sw by w	3.19	3.13	3.07	3.01	2.55	2.48	2.42	2.36	2.29	2.24	2.19
w s w	4.09	4.02	3.55	3.48	3.41	3.34	3.26	3.19	3.11	3.04	2.59
w by s	5.03	4.56	4.48	4.40	4.33	4.25	4.16	4.08	3.59	3.52	3.46
West	6.00	5.52	5.44	5.36	5.28	5.20	5.12	5.03	4.54	4.46	4.40
w by n				6.34	6.26	6.18	6.10	6.01	5.53	5.45	5.40
w n w							7.08	7.00	6.53	6.46	6.41
nw by w										7.45	7.41
☉ fet	6.00	6.13	6.26	6.39	6.52	7.06	7.20	7.35	7.51	8.05	8.16
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	00.0	4.03	8.08	12.13	16.23	20.35	24.52	29.14	33.44	37.27	40.23

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.37	0.38	0.39	0.41	0.42	0.43	0.44	0.46	0.47	0.48
s s w	1.12	1.15	1.17	1.20	1.22	1.25	1.27	1.30	1.33	1.35	1.37
sw by s	1.51	1.55	1.58	2.02	2.06	2.10	2.13	2.17	2.22	2.25	2.28
s w	2.33	2.38	2.43	2.48	2.53	2.58	3.03	3.08	3.13	3.18	3.22
sw by w	3.19	3.25	3.31	3.37	3.43	3.49	3.56	4.02	4.10		
w s w	4.09	4.16	4.23	4.30	4.37	4.44					
w by s	5.03	5.11	5.19								
West	6.00										
☉ fet	6.00	5.47	5.34	5.21	5.08	4.54	4.40	4.25	4.09	3.55	3.44



A Sun-Dial for the Latitude of 53 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	30m h m	h m	30m h m	h m	30m h m	h m	30m h m	h m	h m	29m h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.26	0.25	0.24
s s w	1.13	1.11	1.08	1.06	1.04	1.01	0.59	0.56	0.53	0.51	0.50
sw by s	1.52	1.49	1.45	1.41	1.38	1.34	1.31	1.27	1.23	1.19	1.17
s w	2.34	2.30	2.25	2.20	2.15	2.10	2.05	2.00	1.55	1.51	1.47
sw by w	3.20	3.15	3.09	3.03	2.57	2.51	2.45	2.38	2.32	2.26	2.22
w s w	4.10	4.04	3.57	3.50	3.43	3.36	3.29	3.22	3.14	3.08	3.03
w by s	5.04	4.57	4.49	4.42	4.34	4.27	4.19	4.11	4.02	3.55	3.50
West	6.00	5.52	5.45	5.37	5.29	5.22	5.13	5.05	4.56	4.49	4.43
w by n				6.34	6.26	6.19	6.11	6.03	5.54	5.47	5.42
w n w							7.08	7.01	6.53	6.47	6.42
nw byw									7.51	7.46	7.42
☉ fet	6.00	6.14	6.27	6.41	6.54	7.08	7.23	7.39	7.56	8.10	8.21
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	4.09	8.19	12.31	16.46	21.5	25.28	29.59	34.39	38.29	41.29

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	30m h m	h m	30m h m	h m	30m h m	h m	30m h m	h m	h m	29m h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.37	0.38	0.40	0.41	0.42	0.43	0.45	0.46	0.47	0.48
s s w	1.13	1.16	1.18	1.20	1.23	1.25	1.28	1.30	1.33	1.35	1.37
sw by s	1.52	1.56	2.00	2.03	2.07	2.10	2.14	2.18	2.22	2.25	2.28
s w	2.34	2.39	2.44	2.49	2.54	2.58	3.03	3.09	3.14	3.18	3.22
sw by w	3.20	3.26	3.32	3.38	3.44	3.50	3.56	4.12			
w s w	4.10	4.17	4.24	4.30	4.37	4.44					
w by s	5.04	5.11	5.19								
West	6.00										
☉ fet	6.00	5.46	5.33	5.19	5.06	4.52	4.37	4.21	4.04	3.50	3.39



## A Sun-Dial for the Latitude of 54 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.35	0.34	0.33	0.32	0.31	0.29	0.28	0.27	0.26	0.25
s s w	1.14	1.12	1.09	1.07	1.05	1.02	1.00	0.57	0.55	0.53	0.51
sw by s	1.54	1.50	1.47	1.43	1.40	1.36	1.32	1.29	1.25	1.22	1.19
s w	2.36	2.31	2.27	2.22	2.17	2.12	2.08	2.03	1.57	1.53	1.50
sw byw	3.22	3.16	3.11	3.05	2.59	2.53	2.47	2.41	2.35	2.29	2.25
w s w	4.12	4.05	3.59	3.52	3.45	3.39	3.32	3.24	3.17	3.11	3.06
w by s	5.05	4.58	4.51	4.43	4.36	4.29	4.21	4.13	4.05	3.58	3.53
West	6.00	5.53	5.45	5.38	5.31	5.23	5.15	5.07	4.59	4.52	4.46
w by n				6.34	6.27	6.19	6.12	6.04	5.56	5.49	5.44
w n w							7.09	7.01	6.54	6.48	6.43
nw byw									7.51	7.46	7.42
☉ fet	6.00	6.14	6.28	6.42	6.56	7.11	7.27	7.43	8.00	8.15	8.27
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	4.15	8.31	12.49	17.11	21.36	26.7	30.46	35.35	39.26	42.46

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.38	0.39	0.40	0.41	0.42	0.44	0.45	0.46	0.47	0.48
s s w	1.14	1.16	1.19	1.21	1.24	1.26	1.28	1.31	1.33	1.35	1.37
sw by s	1.54	1.57	2.01	2.04	2.08	2.11	2.15	2.19	2.23	2.26	2.28
s w	2.36	2.41	2.45	2.50	2.54	2.59	3.04	3.09	3.15	3.19	3.22
sw byw	3.22	3.27	3.33	3.39	3.44	3.50	3.56	4.03			
w s w	4.12	4.18	4.24	4.31	4.38	4.45					
w by s	5.05	5.12	5.19								
West	6.00										
☉ fet	6.00	5.46	5.32	5.18	5.04	4.49	4.33	4.17	4.00	3.45	3.33



A Sun-Dial for the Latitude of 55 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.36	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.27	0.26
s s w	1.15	1.13	1.10	1.08	1.06	1.03	1.01	0.59	0.56	0.54	0.52
sw by s	1.55	1.51	1.48	1.45	1.41	1.38	1.34	1.30	1.27	1.23	1.21
s w	2.37	2.33	2.28	2.24	2.19	2.14	2.10	2.05	2.00	1.55	1.52
sw by w	3.23	3.18	3.12	3.07	3.01	2.50	2.50	2.44	2.38	2.33	2.29
w s w	4.13	4.06	4.00	3.54	3.47	3.41	3.34	3.27	3.20	3.14	3.10
w by s	5.05	4.59	4.52	4.45	4.38	4.31	4.23	4.16	4.08	4.02	3.56
West	6.00	5.53	5.46	5.39	5.32	5.24	5.17	5.09	5.01	4.54	4.49
w by n				6.34	6.27	6.20	6.13	6.05	5.57	5.51	5.46
w n w							7.09	7.02	6.55	6.49	6.44
nw by w									7.51	7.46	7.42
☉ set	6.00	6.14	6.29	6.43	6.58	7.14	7.30	7.47	8.05	8.21	8.33
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	4.21	8.44	13.9	17.37	22.10	26.49	31.37	36.36	40.47	44.00

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.38	0.39	0.40	0.42	0.43	0.44	0.45	0.46	0.47	0.48
s s w	1.15	1.17	1.20	1.22	1.24	1.26	1.29	1.31	1.34	1.36	1.38
sw by s	1.55	1.58	2.01	2.05	2.08	2.12	2.16	2.19	2.23	2.26	2.29
s w	2.37	2.42	2.46	2.51	2.55	3.00	3.05	3.10	3.15	3.19	3.22
sw by w	3.23	3.29	3.34	3.40	3.45	3.51	3.57	4.03			
w s w	4.13	4.19	4.25	4.32	4.38	4.45					
w by s	5.05	5.12	5.19								
West	6.00										
☉ set	6.00	5.46	5.31	5.17	5.02	4.46	4.30	4.13	3.55	3.39	3.30



## A Sun-Dial for the Latitude of 56 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.28	0.27	0.26
s s w	1.16	1.14	1.11	1.09	1.07	1.05	1.02	1.00	0.57	0.55	0.53
sw by s	1.56	1.53	1.49	1.46	1.43	1.39	1.36	1.32	1.28	1.26	1.23
s w	2.39	2.34	2.30	2.26	2.21	2.16	2.12	2.07	2.02	1.59	1.55
sw byw	3.25	3.19	3.14	3.09	3.03	2.58	2.52	2.46	2.40	2.36	2.32
w s w	4.14	4.08	4.02	3.56	3.50	3.43	3.37	3.30	3.23	3.17	3.13
w by s	5.06	5.00	4.53	4.46	4.40	4.33	4.26	4.18	4.11	4.05	4.00
West	6.00	5.53	5.46	5.39	5.32	5.26	5.18	5.11	5.03	4.57	4.52
w by n				6.34	6.28	6.21	6.14	6.06	5.59	5.53	5.48
w n w						7.15	7.09	7.02	6.55	6.50	6.45
nw byw									7.51	7.46	7.43
☉ fet	6.00	6.15	6.30	6.45	7.00	7.16	7.34	7.52	8.10	8.27	8.41
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	4.28	8.57	13.29	18.5	22.46	27.34	32.32	37.42	42.4	45.27

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.47	0.48	0.48
s s w	1.16	1.18	1.20	1.22	1.25	1.27	1.29	1.32	1.34	1.36	1.38
sw by s	1.56	1.59	2.02	2.06	2.09	2.13	2.16	2.20	2.24	2.26	2.29
s w	2.39	2.43	2.47	2.52	2.56	3.01	3.06	3.10	3.15	3.19	
sw byw	3.25	3.30	3.35	3.40	3.46	3.51	3.57	4.03			
w s w	4.14	4.20	4.26	4.32	4.38						
w by s	5.06	5.13	5.19								
West	6.00										
☉ fet	6.00	5.45	5.30	5.15	5.00	4.44	4.26	4.08	3.50	3.33	3.19



A Sun-Dial for the Latitude of 57 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.37	0.36	0.35	0.34	0.32	0.31	0.30	0.29	0.28	0.27
s s w	0.17	1.14	1.12	1.10	1.08	1.06	1.04	1.01	0.59	0.57	0.55
sw by s	1.57	1.54	1.51	1.47	1.44	1.41	1.37	1.34	1.30	1.27	1.25
s w	2.40	2.36	2.32	2.27	2.23	2.18	2.14	2.10	2.05	2.01	1.58
sw by w	3.26	3.21	3.16	3.11	3.05	3.00	2.55	2.49	2.43	2.38	2.34
w s w	4.15	4.09	4.03	3.57	3.51	3.45	3.39	3.33	3.26	3.20	3.16
w by s	5.07	5.01	4.54	4.47	4.41	4.34	4.28	4.21	4.13	4.07	4.03
West	6.00	5.53	5.47	5.40	5.33	5.27	5.20	5.12	5.05	4.59	4.54
w by n				6.34	6.28	6.21	6.14	6.07	6.00	5.54	5.50
w n w						7.15	7.09	7.03	6.56	6.51	6.46
nw by w									7.52	7.47	7.43
n w											8.38
☉ fet	6.00	6.16	6.31	6.47	7.03	7.20	7.38	7.56	8.16	8.34	8.48
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	4.35	9.11	13.52	18.33	23.24	28.22	33.31	38.53	43.27	47.2

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.39	0.40	0.41	0.42	0.43	0.44	0.46	0.47	0.48	0.49
s s w	1.17	1.19	1.21	1.23	1.25	1.27	1.30	1.32	1.34	1.36	1.38
sw by s	1.57	2.00	2.03	2.07	2.10	2.13	2.17	2.20	2.24	2.27	2.29
s w	2.40	2.44	2.48	2.53	2.57	3.02	3.06	3.10	3.15	3.19	
sw by w	3.26	3.31	3.36	3.41	3.46	3.51	3.57	4.03			
w s w	4.15	4.21	4.26	4.32	4.38						
w by s	5.07	5.13	5.19								
West	6.00										
☉ fets	6.00	5.44	5.29	5.13	4.57	4.40	4.22	4.04	3.44	3.26	3.12



## A Sun-Dial for the Latitude of 58 Degree.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28
s s w	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.02	1.00	0.58	0.57
sw by s	1.58	1.55	1.52	1.49	1.46	1.42	1.39	1.36	1.32	1.29	1.27
s w	2.41	2.37	2.33	2.29	2.25	2.20	2.16	2.12	2.07	2.04	2.01
sw by w	3.27	3.22	3.17	3.12	3.07	3.02	2.57	2.51	2.46	2.41	2.38
w s w	4.16	4.10	4.05	3.59	3.53	3.47	3.41	3.35	3.29	3.23	3.19
w by s	4.07	5.01	4.55	4.49	4.43	4.36	4.30	4.23	4.16	4.10	4.06
West	6.00	5.54	5.47	5.41	5.34	5.28	5.21	5.14	5.08	4.02	4.57
w by n				6.34	6.28	6.22	6.15	6.08	6.02	5.56	5.51
w n w						7.16	7.10	7.03	6.57	6.52	6.48
nw by w								7.57	7.52	7.47	7.44
n w											8.38
☉ set	6.00	6.16	6.32	6.49	7.06	7.24	7.42	8.01	8.22	8.41	8.56
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	00.0	4.43	9.26	14.16	19.7	24.6	29.14	44.34	40.12	14.59	48.46

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 m 29 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.39	0.40	0.41	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.17	1.19	1.22	1.24	1.26	1.28	1.30	1.32	1.35	1.37	1.38
sw by s	1.58	2.01	2.04	2.07	2.10	2.14	2.17	2.21	2.24	2.27	2.29
s w	2.41	2.45	2.49	2.53	2.57	3.02	3.06	3.10	3.15	3.19	
sw by w	3.27	3.32	3.37	3.42	3.47	3.52	3.57				
w s w	4.16	4.21	4.27	4.33	4.38						
w by s	5.07	5.13	5.19								
West	6.00										
☉ set	6.00	5.44	5.28	5.11	4.54	4.36	4.18	3.59	3.38	3.19	3.04



A Sun-Dial for the Latitude of 59 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.38	0.37	0.36	0.35	0.34	0.32	0.31	0.30	0.29	0.29
s s w	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.01	1.00	0.58
sw by s	1.59	1.56	1.53	1.50	1.47	1.44	1.41	1.38	1.34	1.31	1.29
s w	2.42	2.38	2.35	2.31	2.27	2.23	2.19	2.14	2.10	2.06	2.03
sw by w	3.28	3.24	3.19	3.14	3.09	3.04	2.59	2.54	2.49	2.44	2.41
w s w	4.17	4.12	4.06	4.01	3.55	3.49	3.43	3.38	3.32	3.26	3.22
w by s	5.08	5.02	4.56	4.50	4.44	4.38	4.32	4.25	4.19	4.13	4.09
West	6.00	5.54	5.48	5.42	5.35	5.29	5.23	5.16	5.09	5.04	4.59
w by n				6.35	6.29	6.22	6.16	6.10	6.03	5.58	5.53
w n w						7.16	7.10	7.04	6.58	6.53	6.49
nw by w								7.57	7.52	7.48	7.44
n w										8.42	8.38
☉ set	6.00	6.16	6.33	6.50	7.08	7.27	7.46	8.07	8.29	8.49	9.05
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0.00	4.51	9.43	14.41	19.41	24.51	30.12	35.43	41.37	46.40	50.42

SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.18	1.20	1.22	1.24	1.26	1.28	1.31	1.33	1.35	1.37	1.38
sw by s	1.59	2.02	2.05	2.08	2.11	2.14	2.18	2.21	2.24	2.27	2.29
s w	2.42	2.46	2.50	2.54	2.58	3.02	3.06	3.11	3.15		
sw by w	3.28	3.33	3.38	3.43	3.47	3.52	3.57				
w s w	4.17	4.22	4.28	4.33	4.39						
w by s	5.08	5.14	5.19								
West	6.00										
☉ set	6.00	5.44	5.27	5.10	4.52	4.33	4.14	3.53	3.31	3.11	2.55



## A Sun-Dial for the Latitude of 60 Degrees.

## NORTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.29
s s w	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.03	1.01	1.00
sw by s	2.00	1.57	1.54	1.51	1.48	1.45	1.42	1.39	1.36	1.33	1.31
s w	2.44	2.40	2.36	2.32	2.28	2.24	2.20	2.16	2.12	2.08	2.06
sw by w	3.29	3.25	3.20	3.16	3.11	3.06	3.01	2.56	2.51	2.47	2.44
w s w	4.18	4.13	4.07	4.02	3.57	3.51	3.46	3.40	3.34	3.29	3.25
w by s	5.08	5.03	4.57	4.51	4.45	4.40	4.34	4.27	4.21	4.16	4.12
West	6.00	5.54	5.48	5.42	5.36	5.31	5.24	5.18	5.11	5.06	5.02
w by n				6.35	6.29	6.23	6.17	6.11	6.04	5.59	5.55
w n w						7.16	7.10	7.04	6.59	6.54	6.50
nw by w								7.57	7.52	7.48	7.45
n w										8.41	8.39
☉ fet	6.00	6.17	6.35	6.52	7.11	7.30	7.51	8.13	8.36	8.58	9.16
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0.00	5.00	10.2	15.8	20.18	25.39	31.09	36.58	43.10	48.32	52.51

## SOUTH DECLINATION.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	1.38
sw by s	2.00	2.03	2.06	2.09	2.12	2.15	2.18	2.21	2.24	2.27	2.29
s w	2.44	2.47	2.51	2.55	2.59	3.03	3.07	3.11	3.15		
sw by w	3.29	3.34	3.39	3.43	3.48	3.53	3.58				
w s w	4.18	4.23	4.28	4.33	4.39						
w by s	5.08	5.14	5.20								
West	6.00										
☉ fet	6.00	5.43	5.25	5.08	4.49	4.30	4.09	3.47	3.24	3.02	2.44



*The Description and Use of the foregoing Sun-Dial*

T A B L E S.

**T**H E S E Tables are intituled at the Head of each Page thus: *A Sun-Dial for the Latitude of 0 Degrees*; the next is, *A Sun-Dial for the Latitude of 1 Degree*, and so on orderly to 60 Degrees, making in all 61 Dials; from Page 24 to Page 84.

Each Dial hath two Tables (the uppermost for North Declination, the lowermost for South Declination) and 12 Columns in each Table: At the Head of each Column, and right against Deg. Min. are the Degrees of Declination thus; | 0d. | 2d. 30m. | 5d. | 7d. 30m. | 10d. | 12d. 30m. | 15d. | 17d. 30m. | 20d. | 22d. | 23d. 29m. | ; d. standing for Degree, and m. for Minute.

Under those Degrees and Minutes of Declination in each Column is set | h. m. | ; h. stands for Hour, and m. for Minutes of an Hour.

In the Left-hand Column of each Table under Points (at the Head) are the Points of the Compass, thus, South, S. by W. SSW. SW. by S. SW. &c. S. by W. standing for South and by West; SSW. for South South West; SW. by S. for South West by South, and so for the rest.

At the Foot of each Table, is the Sun's Setting and Sun's Amplitude, agreeable to those several Declinations at the Head of each Column; and are distinguished from the rest by the Words in the Left-hand Column, thus, ☉ set, Sun's Amplitude, or so much of them as the Column can contain. *Note*, the Sun's setting is annexed to each Table, but the Sun's Amplitude only to that for North Declination, because it's the same (for Quantity) for South Declination.

The Sun's setting is Hours and Minutes, but the Amplitude is Degrees and Minutes, having (d) over the Degrees, and (m) over the Minutes.



By these Tables (being Sun-Dials for all Latitudes) may be known the Time of the Day, the Sun being visible in any Part of the Hemisphere, as true and exact as though he was upon the Meridian; also his Rising, Setting and Amplitude. The like may be known by any Star, whose Declination doth not exceed 23d. 29m. as will be evident by the following Propositions.

*Proposition 1.* **T**HE Latitude of a Place, the Sun's Declination, and his Bearing given; to find the Hour of the Day.

*Note,* By Bearing is meant the Azimuth, or Point of the Compass he is upon; and that is found by setting the Sun with an Azimuth Compass, which is the truest way, proper Allowance being made for the Variation, and is to be preferred before setting the Sun with a common Compass.

*The Resolution of this Proposition is thus;*

1. Seek in the *Sun-Dial Tables* for the given Latitude.
2. At the Head of the Table seek the given Declination, or the nearest to it.
3. Find the given Bearing among the Points of the Compass in the Left-hand Column.
4. Then look strait to the Right hand of the Bearing till you come right under the Declination (before found) in the Head of the Table, and what Number you find there, is the Hour required.

*Example 1.* In the Latitude of 30 degrees, the Sun having 15 degrees North Declination, I desire to know at what a Clock the Sun cometh upon the SW. Point of the Compass?

Look for the Table that belongeth to the Latitude of 30 Degrees, in the Head of the Table, which is in Page 54, and look for 15d. in the Column under North Declination, and for SW. on the Left-hand of the Table, and then in the common Angle of Meeting you'll find the Hour of the Day to be oh. 58m. that is 58m. past 12 a Clock, the Time required.

*Example*



*Example 2.* I desire to know at what a Clock the Sun cometh to the SW. in the Latitude of 30 degrees, the Sun having 15 degrees South Declination? *Answer,* 34 minutes past 2 a Clock.

For if you turn to the Dial for Latitude 30 degrees in Page 54, and in the Table for South Declination, seek 15d. at the Head of it, under which, and right against SW. (on the Left-hand) you'll find 2h. 34m. the Time of the Day required.

If the Declination be not the same with the Declination in the Head of the Table; then look under that Declination nearest to the Declination proposed.

But more exactly thus, *Find the Hour for the next Declination both less and greater than the Declination proposed,* and take the Difference of those Hours, as also of the Declination belonging to them: Then say,

As the last Difference, is to the first Difference; so is the Difference between the Declination proposed and the next less in the Table, to a fourth Proportional, which add to (*when the Hour in the Table increaseth*) or (*when it decreaseth*) subtract from the Hour belonging to the less Declination aforesaid: So you'll have the Hour required exact to the Declination proposed.

*Example 3.* Admit the Declination to be 18 deg. 20 min. North, I desire to know at what a Clock the Sun cometh upon the WSW. Point of the Compass, in the Latitude of 30 degrees?

In the Table, the nearest Number to 18 deg. 20 min. is 17d. 30m. Then under 17d. 30m. and against WSW. is 1h. 42m. which sheweth that the Sun cometh upon the WSW. Point of the Compass, at 42m. past one a Clock.

Now because the Declination proposed, and the Declination in the Head of the Table, are somewhat different; therefore you may make a Proportion very easily thus, under 17d. 30m. and against WSW. you'll find

F 4

1h.



1h. 42m. and under 20d. 00m. you'll find 1h. 25m. the difference between these two Numbers is 17m. And the difference between the Declination 17d. 30m. and 20d. is 2d. 30m. or 150m. Also the difference between the Declination 18d. 20m. and 17d. 30m. is 50m. Then say, As 150m. is to 17m. so is 50m. to 6m. almost: But because 50 is  $\frac{1}{3}$  of 150, therefore the third part of 17m. is near 6m. which subtracted from 1h. 42m. (because the Hour decreaseth) and the Remainder 1h. 36m. is the true Hour of the Day, the Sun being upon the W.SW. Point of the Compass, having 18 Degrees 20 min. North Declination.

Do the like with any other Degrees and Minutes of Declination: But if the Declination be not very different from that in the Head of the Table, you need not make any Proportion: Likewise when the Sun is near the Meridian, you need not make any Proportion, because there the difference is but small.

*Note,* There are none but the *Afternoon Points* in the Tables of these *Dials*, yet you may easily find the Time of the Day for the *Forenoon Points* by what follows.

For Points equally distant from the Meridian, are equal Time from Noon, so that at what space of Time from Noon the Sun is S.E. in the Forenoon, the like space of Time from Noon he is S.W. Afternoon.

As in the Table following, the Points that stand right against one another, are equally distant from the Meridian; therefore to find the Hour of the Day, the Sun being upon any of the Forenoon Points; see what Time of the Day it is when the Sun is upon the Afternoon Points that stand right against the Forenoon Points desired, and subtract those Hours and Minutes from 12 Hours, the Remainder is the Hour and Minute of the Day required.



A TABLE of the Points of the Compass, equally distant from the Meridian.

Forenoon Points.	Afternoon Points.
<p>South.</p> <p>South by East</p> <p>South South East</p> <p>South East by South</p> <p>South East</p> <p>South East by East</p> <p>East South East</p> <p>East by South</p> <p>East.</p>	<p>South.</p> <p>South by West</p> <p>South South West</p> <p>South West by South</p> <p>South West</p> <p>South West by West</p> <p>West South West</p> <p>West by South</p> <p>West.</p>
<p>East by North</p> <p>East North East</p> <p>North East by East</p> <p>North East</p> <p>North East by North</p> <p>North North East</p> <p>North by East</p> <p>North.</p>	<p>West by North</p> <p>West North West</p> <p>North West by West</p> <p>North West</p> <p>North West by North</p> <p>North North West</p> <p>North by West</p> <p>North.</p>
Forenoon Points.	Afternoon Points.

*Example 4.* In the Latitude of 60 degrees, the Sun being North East; I demand the Hour of the Day, the Sun having 22 Degrees North Declination.

In the *Sun-Dial* for Latitude 60 Degrees, (in Page 84) look against N.W. which is the *Afternoon Point*, corresponding to N.E. the *Forenoon Point*,) and finding the Declination 22 Degrees in the Head of the Table, in the common Angle of Meeting is 8 Hours 41 Minutes, which subtract from 12 Hours, the Remainder 3 Hours 19 Minutes, is the Hour of the Day required in the Moring.

*Example*



*Example 5.* The Sun being ENE. in the same Latitude, with the same Declination; I demand the Hour of the Day?

In Latitude 60 degrees, and North Declination 22 degrees, the Sun being WNW. it is 54 Minutes past 6 a Clock in the Afternoon; which subtract from 12 Hours, the Remainder is 6 minutes past 5 in the Morning; the Time desired.

*Example 6.* In the Latitude 35 degrees North, the Sun having 15 degrees North Declination, and being South East by East; I demand the Hour and Minute of the Day?

In the Table for Latitude 35 degrees (in Page 59) look against SW. by W. (the Afternoon Point) correspondent to SE. by E. the Forenoon Point.) And the Declination 15d. in the Head of the Table, and in the common Angle of Meeting is 1h. 45m. which deducted from 12 Hours, the Remainder is 15 minutes past 10 a Clock, the true Time of the Day desired.

*Example 7.* In the Latitude 35 degrees North, the Sun having 15 degrees South Declination, and being SE. by E. I demand the Hour of the Day?

*Ans.* 20 Minutes past 8 a Clock; for the Hour in the Table is 3 Hours 40 Minutes, which subtracted from 12 Hours, leaveth 8 Hours 20 Minutes, the Hour required.

The like is to be understood of any other Latitude, with any other Declination, and with any other Point of the Compass.

*Note;* These Tables serve as well in *South Latitude*, as in *North Latitude*, only the Difference will be this;

If the Latitude be contrary, then the Declination must be contrary, and the Points of the Compass contrary; that is to say, North Declination must be counted South; and South Declination must be counted North; and the South Point



Point must be North; and S. by W. must be N. by W. and SSW. must be NNW. and SW. by S. must be NW. by N. and so for any other Point, as in the following Table.

A TABLE of Points equal distant from Noon, both in North Latitude, and in South Latitude; either before Noon or Afternoon.

North Latitude.		South Latitude.	
Forenoon.	Afternoon.	Forenoon.	Afternoon.
S by E. SSE. SE by S. South East.	S by W. SSW. SW by S. South West.	N by E. NNE. NE by N. North East.	N by W. NNW. NW by N. North West.
SE by E. ESE. E by S. East.	SW by W. WSW. W by S. West.	NE by E. ENE. E by N. East.	NW by W. WNW. W by N. West.
E by N. ENE. NE by E. North East.	W by N. WNW. NW by W. North West.	E by S. ESE. SE by E. South East.	W by S. WSW. SW by W. South West.
NE by N. NNE. N by E. North.	NW by N. NNW. N by W. North.	SE by S. SSE. S by E. South.	SW by S. SSW. S by W. South.

Proposition 2. *To find the Hour of the Night by the Stars, and the Tables of Sun-Dials.*

**Y**OU may find the Hour of the Night by the Bearing of any known Star, whose Declination doth not exceed the Sun's greatest Declination, after this manner.

Find



Find the Time of the *Star's* coming to the Meridian on the Day proposed; then if the Star be on the East-side of the Meridian, subtract the Hours and Minutes which these Tables shews, from the Time of the *Star's* coming to the Meridian, the Remainder is the Hour of the Night: But if the Star be on the West-side of the Meridian, then add those Hours and Minutes abovesaid, to the Time of the *Star's* coming to the Meridian, the Sum is the Hour of the Night.

To find what Time the *Star's* come upon, or to the Meridian, see the *Mariner's Calendar*, in the Uses of the Tables of the Sun's, and a *Star's* Right Ascension, Pages 57, 58, 59, 60 and 61.

*Example 8.* Admit the 26th Day of *October*, in the Latitude 40 degrees North, I observe the *Bull's Eye* to be SE. I demand the Hour of the Night.

The 26th Day of *October*, the *Bull's Eye* cometh on the Meridian at 19 Minutes past 2 a Clock in the Morning; this *Star's* Declination is 16 deg. North, therefore in the Table that belongs to 40 Degrees in Page 64, seek in the Head of the Table the Declination of the *Star*, or nearest thereto, and by the Side, the Point of the Compass, and in the common Angle of Meeting, is 1h. 31m. which subtracted from 2 hours 19 min. the *Star's* Southing, the Remainder 0 hour 48 min. is the Hour of the Night desired. But if this *Star* had born SW. you must have added, and then the Hour would have been 50 min. past 3 a Clock in the Morning.

*The Operation.*

	h.	m.
The Time of the <i>Star's</i> , being in the Meridian	2	: 19
His Distance from the Meridian either at SE. or SW.	1	: 31
		<hr/>
The Time of the Night, the <i>Star</i> being SE.	- -	0 : 48
		<hr/>
The Time of the Night, the <i>Star</i> being SW.	- -	3 : 50

*Example*



*Example 9.* Admit the 10th Day of November, in Latitude 45 Degrees North; I see the *Lion's Tail* upon the E.S.E. Point of the Compass, having Declination 15d. 54min. North, I demand the Hour of the Night.

*The Operation.*

	h.	m.
Time of the Star's being on the Meridian	08	10 Morn.
His Distance from the Meridian being	- 03	01

Time of the Night, the Star is E.S.E. - 05 : 09 Morn.

Time when this Star is W.S.W. - - - 11 : 11 Morn.

*Note*; If the Compass hath Variation, you must allow for the Variation; but if you will use this following Instrument, which I call the Rectifier, you need not reckon which way the Variation is, either Eastward or Westward; for this Instrument will do it so plain, that you cannot be mistaken, as is shewn in the following part of this Book: But for the present I will only give you one *Proposition*, and apply it upon the Rectifier, which is as followeth;

*Proposition.* Admit in Latitude 47 degrees North, the Sun being in one of the Equinoctial Points, at which Time he hath no Declination, I observe the Sun to rise upon the E.S.E. Point of the Compass, I demand the Variation?

The Sun having no Declination, in any Latitude (if there be no Variation) the Sun will rise at East, and set at West; but according to the foregoing *Proposition*, the Sun did rise E.S.E. therefore there is two Points Variation, as will appear by the following Rectifier.

*The Description of the RECTIFIER.*

**T**HIS Instrument containeth two Circles or Compasses one within the other: but as it is made of Wood, the one moveth upon the other; so that the inward or upper



upper Circle representeth the Compass that you steer by, which is subject to Variation : But the outward or under Circle, representeth a true Compass that never varieth. And by it you may readily rectify your Compass when it doth vary, thus ;

Always bring the true Point of Rising or Setting on the outward or under Compass, to touch the false Point of Rising or Setting, on the inward or upper Compass, there let the Instrument stand.

As in the foregoing *Proposition* : The East Point is the true Point of Rising, and ESE. Point is the false Point of Rising, therefore bring the East Point on the outward or under Compass, to touch the ESE. Point on the inward or upper Compass.

Then the Points that are on the outward or true Compass, do explain the Points that are upon the inward or steering Compass ; so that according to this Observation the NNE. Point on your Compass, is the true North Point ; and the North is the true N.N.W. and the N.W. is the true W.N.W. and the West is the true W.S.W. Point ; as plainly appears by the Rectifier.

*Note*, The true Points are always counted on the outward Circle or Compass.

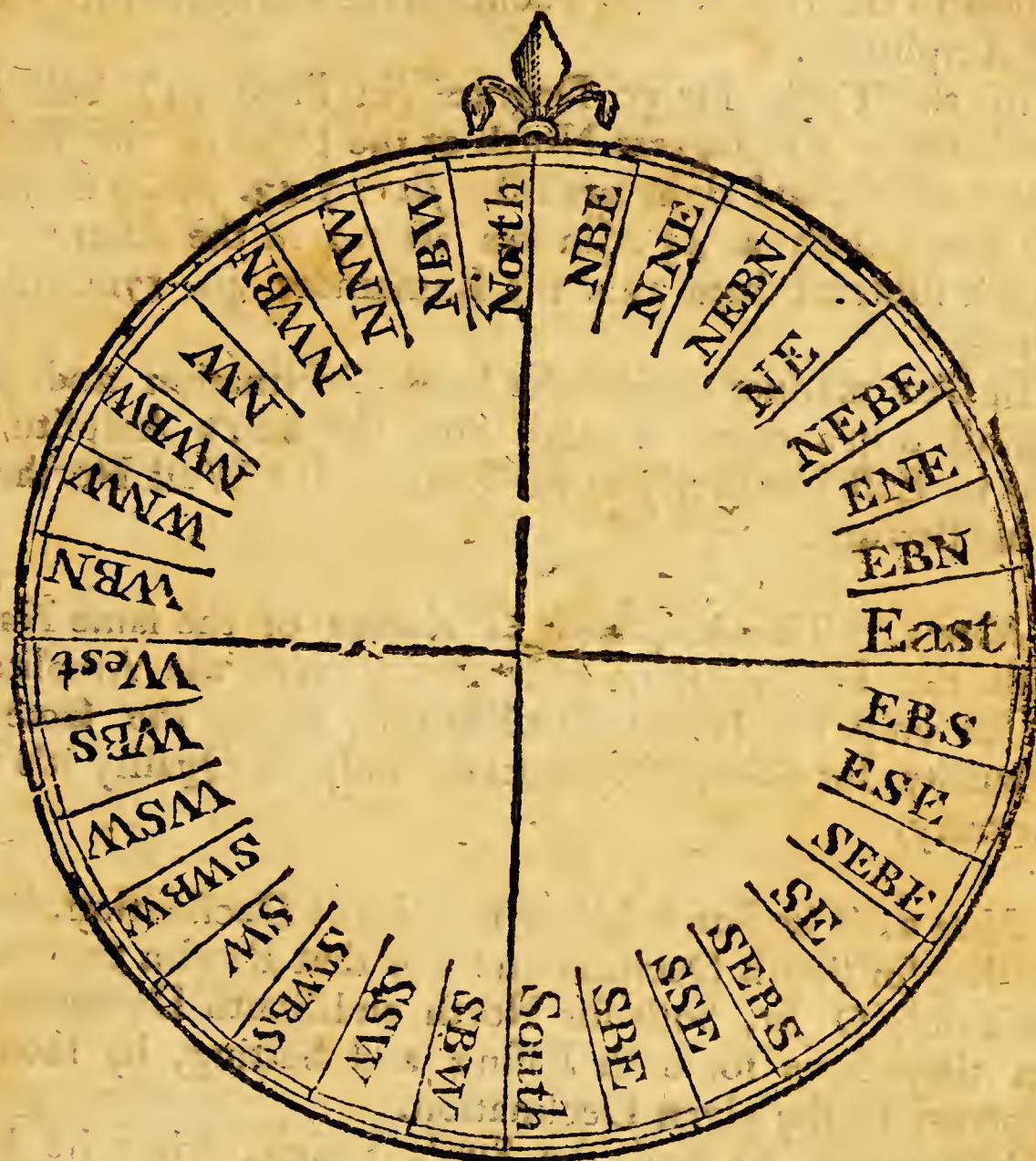
This Instrument in Wood, is larger than this Figure, and there the Points are divided into Halves and Quarters ; as also each Compass (in some) is divided into 360 Degrees, number'd from the North and South, (both ways) towards the East and West, ending there in 90 Degrees.

A right Knowledge of the Quantity and Quality of the *Variation* of the Compass in different Latitudes and Longitudes, is of the utmost Importance, not only in the preceding Proposition, but in all others where *Bearings* are required, and especially in correcting the Courses steered by a Ship at Sea ; for which Purpose an accurate Variation Chart is lately constructed from more than Fifty Thousand actual Observations, by *William Mountaine*, F.R.S. and Sold by Mess. *Mount and Page*, on *Tower-Hill*.

The



The RECTIFIER.



Proposition 3. To find the Sun's Rising, Setting, or Amplitude by the Tables of the Sun-Dials.

**I**N the Table for the Latitude of the Place, seek the Declination, under which, and against  $\odot$  set, is the Sun's Setting; and against Sun's Ampl. is the Amplitude.

Any



And if you subtract the Sun's Setting from 12 Hours it gives its Rising.

*Example 10.* Latitude 50 Degrees North, Sun's Declination 20 Degrees North, I demand his Rising, Setting, and his Amplitude.

In the Table for 50 Degrees (in Page 74) seek the Declination 20 Degrees North at the Head of the Table, under which, and right against  $\odot$  *set* is 7.43. which sheweth the Sun setteth at 43 Minutes after 7 in the Afternoon; which subtract from 12h. the Remainder 4h. 17m. is his Rising.

In like manner under the Sun's Declination 20d. and against Sun's *Ampl.* is 32d. 8m. the Sun's Amplitude; that is, East Northerly at his Rising, but West Northerly at his Setting.

*Note 1.* The Amplitude is always of the same Name with the Declination: For that Reason the Amplitude is set only for North Declination, being the same in Quantity for South Declination, only in Quality it's the contrary.

*Note 2.* The Sun's Rising for North Declination, is the Setting for South Declination: For that Reason the Table hath only  $\odot$  *set*, both for North and South Declination; yet they serve for both Rising and Setting, by looking contrary to the given Declination.

Wherefore, to find the Sun's Rising, when he hath North Declination, look under South Declination; and when he hath South Declination (to find his Rising) look under North Declination.

*Note 3.* In South Latitude with South Declination, also in South Latitude with North Declination, the Sun's Rising and Setting is the same as in North Latitude with North Declination, as also in North Latitude with South Declination.

There



Therefore those Tables are as useful in South Latitude as in North Latitude ; if North Declination in these Tables be counted for South, and South for North.

*Note 4.* The Rising, Setting, and Amplitude of any Star (whose Declination doth not exceed the Sun's greatest Declination) may be found by these Tables ; provided it's Southing, or Time of the Star's coming to or on the Meridian, be known.

For the Time of Sun-setting in these Tables for any Latitude, is a Star's half Continuance above the Horizon, having equal Declination, and the same Kind with the Sun, for the same Latitude.

Therefore the half Continuance of a Star above the Horizon (found in these Tables as before directed) added to, and subtracted from the Time of the Star's coming to, or on the Meridian ; the first is the Star's Setting, the latter it's Rising.

Examples of this Nature you will find in the Use of the next Table of Semidiurnal and Seminocturnal Arches, to which you are referred.

The Amplitude of a Star by the foregoing Tables is found as the Amplitude of the Sun was, which is more fully treated on in the Use of the Tables of Amplitude, in *Page 146.*



*Astronomic TABLES of Semidiurnal and Seminocturnal Arches : Shewing the true Time of the SUN's Rising and Setting ; with the Length of the Day and Night, for any Day in the Year ; fitting all Places in the World, where the Pole is not elevated above 60 Degrees, either North or South ; and to last with Exactness, as long as God upholdeth the Course of Nature.*



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

The Degrees of Latitude.

Sun's Decli.	1		2		3		4		5		6	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	00	06	00	06	00	06	00	06	00	06	00
2	06	00	06	00	06	00	06	00	06	01	06	01
3	06	00	06	00	06	01	06	01	06	01	06	01
4	06	00	06	00	06	01	06	01	06	01	06	02
5	06	00	06	00	06	01	09	01	06	02	06	02
6	06	00	06	01	06	01	06	02	06	02	06	03
7	06	00	06	01	06	01	06	02	06	02	06	03
8	06	00	06	01	06	02	06	02	06	03	06	03
9	06	01	06	01	06	02	06	03	06	03	06	04
10	06	01	06	01	06	02	06	03	06	04	06	04
11	06	01	06	01	06	02	06	03	06	04	06	05
12	06	01	06	02	06	02	06	03	06	04	06	05
13	06	01	06	02	06	03	06	04	06	05	06	06
14	06	01	06	02	06	03	06	04	06	05	06	06
15	06	01	06	02	06	03	06	04	06	05	06	06
16	06	01	06	02	06	03	06	05	06	06	06	07
17	06	01	06	02	06	04	06	05	06	06	06	07
18	06	01	06	03	06	04	06	05	06	07	06	08
19	06	01	06	03	06	04	06	05	06	07	06	08
20	06	01	06	03	06	04	06	06	06	07	06	09
21	06	02	06	03	06	05	06	06	06	08	06	09
22	06	02	06	03	06	05	06	06	06	08	06	10
23	06	02	06	03	06	05	06	07	06	09	06	10
23, 29	06	02	06	04	06	05	06	07	06	09	06	11



A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	7	8	9	10	11	12
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
0	06 00	06 00	06 00	06 00	06 00	06 00
1	06 00	06 00	06 01	06 01	06 01	06 01
2	06 01	06 01	06 01	06 01	06 02	06 02
3	06 01	06 02	06 02	06 02	06 02	06 03
4	06 02	06 02	06 02	06 03	06 03	06 04
5	06 02	06 03	06 03	06 04	06 04	06 04
6	06 03	06 03	06 04	06 04	06 05	06 05
7	06 03	06 04	06 04	06 05	06 05	06 06
8	06 04	06 04	06 05	06 06	06 06	06 07
9	06 04	06 05	06 06	06 06	06 07	06 08
10	06 05	06 06	06 06	06 07	06 08	06 09
11	06 05	06 06	06 07	06 08	06 09	06 09
12	06 06	06 07	06 08	06 09	06 09	06 10
13	06 06	06 07	06 08	06 09	06 10	06 11
14	06 07	06 08	06 09	06 10	06 11	06 12
15	06 08	06 09	06 10	06 11	06 12	06 13
16	06 08	06 09	06 10	06 12	06 13	06 14
17	06 09	06 10	06 11	06 12	06 14	06 15
18	06 09	06 10	06 12	06 13	06 14	06 16
19	06 10	06 11	06 13	06 14	06 15	06 17
20	06 10	06 12	06 14	06 15	06 16	06 18
21	06 11	06 12	06 14	06 16	06 17	06 19
22	06 11	06 13	06 15	06 16	06 18	06 20
23	06 12	06 14	06 15	06 17	06 19	06 21
23, 29	06 12	06 14	06 16	06 17	06 19	06 21



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

The Degrees of Latitude.

Sun's Decli.	13	14	15	16	17	18
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
0	06 00	06 00	06 00	06 00	06 00	06 00
1	06 01	06 01	06 01	06 01	06 01	06 01
2	06 02	06 02	06 02	06 02	06 02	06 02
3	06 03	06 03	06 03	06 03	06 04	06 04
4	06 04	06 04	06 04	06 05	06 05	06 05
5	06 05	06 05	06 05	06 06	06 06	06 06
6	06 06	06 06	06 06	06 07	06 07	06 08
7	06 06	06 07	06 07	06 08	06 09	06 09
8	06 07	06 08	06 09	06 09	06 10	06 10
9	06 08	06 09	06 10	06 10	06 11	06 12
10	06 09	06 10	06 11	06 12	06 12	06 13
11	06 10	06 11	06 12	06 13	06 13	06 14
12	06 11	06 12	06 13	06 14	06 15	06 16
13	06 12	06 13	06 14	06 15	06 16	06 17
14	06 13	06 14	06 15	06 16	06 17	06 19
15	06 14	06 15	06 16	06 18	06 19	06 20
16	06 15	06 16	06 18	06 19	06 20	06 21
17	06 16	06 17	06 19	06 20	06 21	06 22
18	06 17	06 19	06 20	06 21	06 23	06 24
19	06 18	06 20	06 21	06 23	06 24	06 26
20	06 19	06 21	06 22	06 24	06 25	06 27
21	06 20	06 22	06 24	06 25	06 27	06 29
22	06 21	06 23	06 25	06 27	06 28	06 30
23	06 22	06 24	06 26	06 28	06 30	06 32
23, 29	06 23	06 25	06 27	06 29	06 31	06 33

Degrees of Declination.



A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	19		20		21		22		23		24	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	01	06	01	06	01	06	02	06	02	06	02
2	06	03	06	03	06	03	06	03	06	03	06	03
3	06	04	06	04	06	05	06	05	06	05	06	05
4	06	05	06	06	06	06	06	06	06	07	06	07
5	06	07	06	07	06	08	06	08	06	09	06	09
6	06	08	06	09	06	09	06	10	06	10	06	11
7	06	10	06	10	06	11	06	11	06	12	06	13
8	06	11	06	12	06	12	06	13	06	14	06	14
9	06	13	06	13	06	14	06	15	06	15	06	16
10	06	14	06	15	06	16	06	16	06	17	06	18
11	06	15	06	16	06	17	06	18	06	19	06	20
12	06	17	06	18	06	19	06	20	06	21	06	22
13	06	18	06	19	06	20	06	21	06	23	06	24
14	06	20	06	21	06	22	06	23	06	24	06	25
15	06	21	06	22	06	24	06	25	06	26	06	27
16	06	23	06	24	06	25	06	27	06	28	06	29
17	06	24	06	25	06	27	06	28	06	30	06	31
18	06	26	06	27	06	29	06	30	06	32	06	33
19	06	27	06	29	06	30	06	32	06	34	06	35
20	06	28	06	30	06	32	06	34	06	36	06	37
21	06	29	06	32	06	34	06	36	06	37	06	39
22	06	31	06	33	06	35	06	37	06	39	06	41
23	06	33	06	35	06	37	06	39	06	41	06	43
23, 29	06	34	06	36	06	38	06	40	06	42	06	44



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

*The Degrees of Latitude.*

Sun's Declin.	25		26		27		28		29		30	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	02	06	02	06	02	06	02	06	02	06	02
2	06	04	06	04	06	04	06	04	06	04	06	05
3	06	06	06	06	06	06	06	06	06	07	06	07
4	06	07	06	08	06	08	06	09	06	09	06	09
5	06	09	06	10	06	10	06	11	06	11	06	12
6	06	11	06	12	06	12	06	13	06	13	06	14
7	06	13	06	14	06	14	06	15	06	16	06	16
8	06	15	06	16	06	16	06	17	06	18	06	19
9	06	17	06	18	06	19	06	19	06	20	06	21
10	06	19	06	20	06	21	06	22	06	23	06	23
11	06	21	06	22	06	23	06	24	06	25	06	26
12	06	23	06	24	06	25	06	26	06	27	06	28
13	06	25	06	26	06	27	06	28	06	29	06	31
14	06	27	06	28	06	29	06	30	06	32	06	33
15	06	29	06	30	06	31	06	33	06	34	06	36
16	06	31	06	32	06	34	06	35	06	37	06	38
17	06	33	06	34	06	36	06	37	06	39	06	41
18	06	35	06	36	06	38	06	40	06	42	06	43
19	06	37	06	39	06	40	06	42	06	44	06	46
20	06	39	06	41	06	43	06	45	06	47	06	48
21	06	41	06	43	06	45	06	47	06	49	06	51
22	06	43	06	45	06	48	06	50	06	52	06	54
23	06	46	06	48	06	50	06	52	06	54	06	57
23, 29	06	47	06	49	06	51	06	53	06	55	06	58



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

The Degrees of Latitude.

Sun's Declin.	31		32		33		34		35		36	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	02	06	02	06	03	06	03	06	03	06	03
2	06	05	06	05	06	05	06	05	06	06	06	06
3	06	07	06	08	06	08	06	08	06	08	06	09
4	06	10	06	10	06	10	06	11	06	11	06	12
5	06	12	06	13	06	13	06	14	06	14	06	15
6	06	15	06	15	06	16	06	16	06	17	06	18
7	06	17	06	18	06	18	06	19	06	20	06	20
8	06	19	06	20	06	21	06	22	06	23	06	23
9	06	22	06	23	06	24	06	25	06	25	06	26
10	06	24	06	25	06	26	06	27	06	28	06	29
11	06	27	06	28	06	29	06	30	06	31	06	32
12	06	29	06	31	06	32	06	33	06	34	06	36
13	06	32	06	33	06	34	06	36	06	37	06	39
14	06	34	06	36	06	37	06	39	06	40	06	42
15	06	37	06	39	06	40	06	42	06	43	06	45
16	06	40	06	41	06	43	06	45	06	46	06	48
17	06	42	06	44	06	46	06	48	06	49	06	51
18	06	45	06	47	06	49	06	51	06	53	06	55
19	06	48	06	50	06	52	06	54	06	56	06	58
20	06	51	06	53	06	55	06	57	06	59	07	01
21	06	53	06	56	06	58	07	00	07	02	07	05
22	06	56	06	58	07	01	07	03	07	06	07	08
23	06	59	07	01	07	04	07	06	07	09	07	12
23, 29	07	01	07	03	07	06	07	08	07	11	07	14



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

The Degrees of Latitude.

Sun's Declin.	37		38		39		40		41		42	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	03	06	03	06	03	06	03	06	03	06	04
2	06	06	06	06	06	06	06	07	06	07	06	07
3	06	09	06	09	06	10	06	10	06	10	06	11
4	06	12	06	13	06	13	06	13	06	14	06	14
5	06	15	06	16	06	16	06	17	06	17	06	18
6	06	18	06	19	06	20	06	20	06	21	06	22
7	06	21	06	22	06	23	06	24	06	25	06	25
8	06	24	06	25	06	26	06	27	06	28	06	29
9	06	27	06	28	06	29	06	31	06	32	06	33
10	06	31	06	32	06	32	06	34	06	35	06	37
11	06	34	06	35	06	36	06	38	06	39	06	40
12	06	37	06	38	06	40	06	41	06	43	06	44
13	06	40	06	42	06	43	06	45	06	46	06	48
14	06	43	06	45	06	47	06	48	06	50	06	52
15	06	47	06	48	06	50	06	52	06	54	06	56
16	06	50	06	52	06	54	06	56	06	58	07	00
17	06	53	06	55	06	57	07	00	07	02	07	04
18	06	57	06	59	07	01	07	03	07	06	07	08
19	07	00	07	02	07	05	07	07	07	10	07	12
20	07	04	07	06	07	09	07	11	07	14	07	17
21	07	07	07	10	07	12	07	15	07	18	07	21
22	07	11	07	14	07	16	07	19	07	22	07	25
23	07	15	07	17	07	20	07	23	07	27	07	30
23, 29	07	17	07	19	07	22	07	25	07	29	07	32



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

The Degrees of Latitude.

Sun's Declin.	43		44		45		46		47		48	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	04	06	04	06	04	06	04	06	04	06	04
2	06	07	06	08	06	08	06	08	06	09	06	09
3	06	11	06	12	06	12	06	12	06	13	06	13
4	06	15	06	15	06	16	06	17	06	17	06	18
5	06	19	06	19	06	20	06	21	06	22	06	22
6	06	22	06	23	06	24	06	25	06	26	06	27
7	06	26	06	27	06	28	06	29	06	30	06	31
8	06	30	06	31	06	32	06	33	06	35	06	36
9	06	34	06	35	06	36	06	38	06	39	06	41
10	06	38	06	39	06	41	06	42	06	43	06	45
11	06	42	06	43	06	45	06	46	06	48	06	50
12	06	46	06	47	06	49	06	51	06	53	06	55
13	06	50	06	52	06	53	06	55	06	57	06	59
14	06	54	06	56	06	58	07	00	07	02	07	04
15	06	58	07	00	07	02	07	04	07	07	07	09
16	07	02	07	04	07	07	07	09	07	12	07	14
17	07	06	07	09	07	11	07	14	07	17	07	19
18	07	11	07	13	07	16	07	19	07	22	07	25
19	07	15	07	18	07	21	07	24	07	27	07	30
20	07	19	07	22	07	25	07	29	07	32	07	35
21	07	24	07	27	07	30	07	34	07	37	07	41
22	07	28	07	31	07	35	07	39	07	43	07	47
23	07	33	07	36	07	40	07	44	07	48	07	53
23, 29	07	36	07	39	07	43	07	47	07	51	07	56



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

*The Degrees of Latitude.*

Sun's Declin.	49		50		51		52		53		54	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	05	06	05	06	05	06	05	06	05	06	06
2	06	09	06	10	06	10	06	10	06	11	06	11
3	06	14	06	14	06	15	06	15	06	16	06	17
4	06	18	06	19	06	20	06	21	06	21	06	22
5	06	23	06	24	06	25	06	26	06	27	06	28
6	06	28	06	29	06	30	06	31	06	32	06	33
7	06	32	06	34	06	35	06	36	06	38	06	39
8	06	37	06	39	06	40	06	41	06	43	06	45
9	06	42	06	44	06	45	06	47	06	49	06	50
10	06	47	06	49	06	50	06	52	06	54	06	56
11	06	52	06	54	06	56	06	58	07	00	07	02
12	06	57	06	59	07	01	07	03	07	06	07	08
13	07	02	07	04	07	06	07	09	07	11	07	14
14	07	07	07	09	07	12	07	14	07	17	07	20
15	07	12	07	14	07	17	07	20	07	23	07	27
16	07	17	07	20	07	23	07	26	07	29	07	33
17	07	22	07	25	07	29	07	32	07	36	07	40
18	07	28	07	31	07	35	07	38	07	42	07	46
19	07	33	07	37	07	41	07	45	07	49	07	52
20	07	39	07	43	07	47	07	51	07	56	08	00
21	07	45	07	49	07	53	07	58	08	03	08	08
22	07	51	07	55	08	00	08	05	08	10	08	15
23	07	57	08	02	08	06	08	12	08	17	08	23
23, 29	08	00	08	05	08	10	08	16	08	21	08	27



*A TABLE shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.*

The Degrees of Latitude.

Sun's Declin.	55	56	57	58	59	60
	H. M.	H. M.	H. M.	H. M.	H. M.	
0	06 00	06 00	06 00	06 00	06 00	06 00
1	06 06	06 06	06 06	06 06	06 07	06 07
2	06 11	06 12	06 12	06 13	06 13	06 14
3	06 17	06 18	06 19	06 19	06 20	06 21
4	06 23	06 24	06 25	06 26	06 27	06 28
5	06 29	06 30	06 31	06 32	06 33	06 35
6	06 35	06 36	06 37	06 39	06 40	06 42
7	06 40	06 42	06 44	06 45	06 47	06 49
8	06 46	06 48	06 50	06 52	06 54	06 56
9	06 52	06 54	06 56	06 59	07 01	07 04
10	06 58	07 00	07 03	07 06	07 08	07 11
11	07 04	07 07	07 10	07 13	07 16	07 19
12	07 11	07 13	07 16	07 20	07 23	07 26
13	07 17	07 20	07 23	07 27	07 30	07 34
14	07 23	07 27	07 30	07 34	07 38	07 42
15	07 30	07 34	07 38	07 42	07 46	07 51
16	07 37	07 41	07 45	07 49	07 54	07 59
17	07 44	07 48	07 52	07 57	08 03	08 08
18	07 51	07 55	08 00	08 05	08 11	08 17
19	07 58	08 03	08 08	08 14	08 20	08 26
20	08 05	08 11	08 16	08 22	08 29	08 36
21	08 13	08 19	08 25	08 32	08 39	08 47
22	08 21	08 27	08 34	08 41	08 49	08 58
23	08 29	08 32	08 43	08 51	09 00	09 09
23, 29	08 33	08 41	08 48	08 50	09 05	09 16

Degrees of Declination.



The Use of the foregoing T A B L E S of  
*Semidiurnal and Seminocturnal Arches.*

*To find the Time of the Sun's Rising and Setting, and the Length of the Day, and of the Night, by these Tables.*

**F**IRST, seek the Sun's Declination in the Tables of Declination for the Day proposed; with which enter the Tables of Semidiurnal and Seminocturnal Arches; finding the Latitude of the Place in the Head of the Table, and the Degrees of the Sun's Declination in the first Column on the Left-hand; and in the common Angle of Meeting is the Semidiurnal Arch, if the Sun hath North Declination; but its Seminocturnal Arch, if the Sun hath South Declination.

*Example 1.* For Illustration hereof, let it be required to find the Time of the Sun's Rising, Setting, and the Length of the Day and Length of the Night, for the 4th Day of *May*, 1766, in Latitude 46 Degrees North?

At which Time the Sun's Declination is 16 deg. 3 min. North; with which enter the Table, as is before declared, and the Semidiurnal Arch is 7 Hours 9 Min. the true Time of Sun-setting; whose Complement to 12 Hours is the Seminocturnal Arch, or the Time of the Sun-rising, and is 4 Hours 51 Minutes; double the Semidiurnal Arch you have the Length of the Day; double the Seminocturnal Arch, the Aggregate is the Length of the Night. See the Work following.

	H. M.
	12 : 00
The Semidiurnal Arch, or Time of Sun-setting	07 : 09
	<hr style="width: 100%;"/>
The Complement to 12 Hours is - - - - -	04 : 51
	<hr style="width: 100%;"/>

The Seminocturnal Arch, or Time of the Sun-rising, in Latitude 46 Degrees North, is 4 Hours 51 Minutes.

The



	H.	M.
The Semidiurnal Arch doubled - - - - -	{ 07	: 09
	{ 07	: 09
The Length of the Day, <i>May 4, 1766</i> , is—	14	: 18
The Seminocturnal Arch doubled - - - - -	{ 04	: 51
	{ 04	: 51
The Length of the Night, <i>May 4, 1766</i> , is—	09	: 42

*Example 2.* But when the Sun hath 16 deg. 03 min. South Declination, in this Latitude of 46 deg. North; then the Day-Arch will become the Night-Arch, and the Night-Arch will become the Day-Arch.

As, on *Nov. 6, 1763*, the Sun hath 16 deg. 01 min. South Declination; then the Time of the Sun's Rising is 7 Hours 9 Minutes, his Setting 4 Hours 51 Minutes; the Length of the Day 9 Hours 42 Minutes, and the Length of the Night 14 Hours 18 Minutes.

*Example 3.* Let it be required to find the Time of the Sun's Rising and Setting, with the Length of the Day and Night, for the 26th of *December, 1764*, in Latitude 53 deg. North; at which Time the Sun's Declination is 23 deg. 22 min. South?

	H.	M.
	12	: 00
The Seminocturnal Arch, or Time of Sun-rising	08	: 20
The Complement to 12 Hours is - - - - -	03	: 40
And is the Semidiurnal Arch, or Time of Sun-setting.		
The Seminocturnal Arch doubled - - - - -	{ 03	: 40
	{ 03	: 40
The Length of the Day, <i>December 26, 1764</i> , is	07	: 20
The Seminocturnal Arch doubled - - - - -	{ 08	: 20
	{ 08	: 20
The Length of the Night, <i>December 26, 1764</i> , is	16	: 40
	These	



These Tables will serve as well in South Latitude as in North, with this Alteration only; When in South Latitude, then use South Declination there, as you do North Declination here, in North Latitude.

For then these Tables shew the Semidiurnal Arch, or the Time of Sun-rising, when the Sun hath South Declination; and the Seminocturnal Arch, or the Time of Sun-setting, when the Sun hath North Declination.

*Example 4.* Let it be required to find the Time of the Sun's Rising and Setting, with the Length of the Day and Night, for the 4th of *May*, 1765. in Latitude 46 Degrees South.

At which Time the Sun's Declination is 16 Degrees 07 Minutes North; with which enter the Table, and the Seminocturnal Arch is 7 Hours 9 Minutes the Time of Sun-rising; whose Complement to 12 Hours is the Semidiurnal Arch, or Time of Sun-setting, which is at 51 Minutes past 4 of the Clock.

	H. M.
The Seminocturnal Arch doubled - - - - -	{ 07 : 09
	{ 07 : 09
	-----

The Length of the Night, <i>May</i> 4, 1765. in	{	14 : 18
Latitude 46 Degrees South - - - - -	}	
		-----

The Semidiurnal Arch doubled - - - - -	{ 04 : 51
	{ 04 : 51
	-----

The Length of the Day, the 4th of <i>May</i> ,	{	09 : 42
1765. Latitude 46 Degrees South - - - - -	}	

*Example 5.* Let it be required to find the Time of the Sun's Rising and Setting, with the Length of the Day and Night, for the 26th of *December*, 1763. in Latitude 53 Degrees South. At which Time the Sun's Declination is 23 deg. 24 min. South; with which enter the Table of Semidiurnal Arches, &c. and you will find as follows.

H. M.



	H.	M.
	12	: 00
The Semidiurnal Arch, or Time of Sun-setting	08	: 20
<hr/>		
The Seminocturnal Arch, or Time of Sun-rising	03	: 40
<hr/>		
The Length of the Day - - - - -	16	: 40
<hr/>		
Length of the Night, <i>December 26, 1763.</i>	}	07 : 20
Latitude 53 Degrees South - - - - -		

*To find the Time of a Star's Rising or Setting.*

BY these Tables the Time of the Rising and Setting of all the Stars in the Heavens (whose Declinations do not exceed the Sun's greatest Declination,) in any Latitude that the Tables contain, and at any Time of the Year, is found in this Manner.

If the Star hath North Declination, and you in North Latitude, look for the Latitude in the Head in the Table, the Declination on the Left-hand, and in the common Angle of meeting is the Star's Semiapparent Arch, or half the Time of the Star's Continuance above the Horizon, in that Latitude; or the space of Time which that Star takes in ascending from the Horizon to the Meridian, on the East-side; likewise descending from the Meridian, to the Horizon, on the West-side of the Meridian. Now, if you subtract these Hours and Minutes from the Time of the Star's coming to the Meridian, the Remainder will be the Time of the Star's Rising: and if you add, the Sum will be the true Time of the Star's Setting.

*Example 6.* Let it be required to find the Time of the Rising and Setting of the *Bull's Eye*, November the 30th, in the Latitude of 52 Degrees North: The Declination of this Star is 16 deg. North; the 30th Day of November this Star cometh on the Meridian at 56 Minutes past 11 of the Clock at Night.

H. M.



	H.	M.
The Time of the Star's Southing - - - - -	11	56
The Semi-apparent Arch, subtract - - - - -	07	26
<hr/>		
Time of the Star's Rising in the Evening - - -	04	30
<hr/>		
Time of the Star's Setting in the Morning - -	07	22
<hr/>		

*Note* 1. If the Sum of the Addition exceed 12 Hours, cast away 12 Hours; the Surplus is the Star's Setting.

2. And when you can't subtract, add 12 Hours to the Star's Southing, and then subtract: What remains is it's Rising.

*Example* 7. I desire to know the Time of the Rising and Setting of the *Bull's-Eye*, the 30th Day of *November*, in the Latitude of 13 degrees North: The Declination of the *Bull's Eye* 16 deg. North?

	H.	M.
The Time of the Star's Southing - - - - -	11	56
The Semi-apparent Arch, subtract - - - - -	06	15
<hr/>		
The Time of his Rising in the Evening - - -	05	41
<hr/>		
The Time of his Setting in the Morning - - -	06	11

If the Star hath South Declination, and you in North Latitude look (as before) the Latitude in the Head of the Table, the Declination on the Left-side, and in the common Angle of Meeting is the Star's Semi-depressed Arch; which subtract from 12 Hours, the Remainder is the Star's Semi-apparent Arch, or half the Time that the Star doth continue above the Horizon in that Latitude: Therefore subtract those Hours and Minutes from the Time of the Star's coming to the Meridian, adding 12 Hours to the Star's Southing, if otherwise Subtraction cannot be made, the Remainder will be the Time of the Star's Rising; and if you add, the Sum will be the Time of the Star's Setting.

*Example*



*Example 8.* Let it be required to find the Time of the Rising and Setting of the Bright Star in the *Great Dog's Mouth*, the 15th Day of *November*, in the Latitude of 50 deg. North. The Declination of the *Great Dog's Mouth*, is 16d. 24m. South, and its Southing is 3 Hours 12 min. in the Morning, the 15th of *November*.

	H.	M.
The Time of the Star's Southing is - - - - -	03	12
To it add - - - - -	12	00
The Sum is - - - - -	15	12
The Semi-depress'd Arch, by the Table is - -	07	22
Which subtract from - - - - -	12	00
The Remainder is the Semi-apparent Arch - -	04	38
Time of Southing with 12 Hours added is - -	15	12
The Semi-apparent Arch, subtract - - - - -	04	38
Time of the Star's Rising in the Evening - - -	10	34
Time of the Star's Setting from Noon, or 50 } min. past 7 in the Morning - - - - -	19	50

*Example 9.* I desire to know the Rising and Setting of the *Great Dog* the 15th of *November*, in the Latitude of 30 Degrees North.

	H.	M.
Time of Southing with 12 Hours added - - -	15	12
The Semi-apparent Arch, subtract - - - - -	06	39
Time of the Star's Rising in the Evening - - -	08	33
Time of the Star's Setting in the Morning, when } 12 Hours is subtracted - - - - -	9	51

*In South Latitude, to know the Time of the Rising and Setting of the Stars.*

Proceed with those Stars that have North Declination in South Latitude, as with Stars that have South Declination in North Latitude.

H

*Example*



*Example 10.* Let it be required to find the Time of the Rising and Setting of the *Bull's Eye* the 18th Day of November, in the Latitude of 42 deg. South.

The Declination of this Star is 16 deg. 00 min. North: The 18th Day of November, this Star cometh upon the Meridian at 47 min. past 12 in the Morning.

	H.	M.
The Semi-depress'd Arch, by the Table is - - -	07	: 00
Which subtract from - - - - -	12	: 00
The Remainder is the Semi-apparent Arch - - -	05	: 00
The Time of the Star's Northing is - - - - -	12	: 47
The Semi-apparent Arch, subtract - - - - -	05	: 00
Time of the Star's Rising in the Evening - - -	07	: 47
Time of the Star's Setting in the Morning - -	05	: 47

In like manner the Rising and Setting of any Star (whose Declination exceedeth not the Sun's greatest) may be found in any Latitude, from the Equinoctial to 60 Degrees, either North or South.

---

## ASTRONOMIC TABLES;

S H E W I N G

*The Points of the Compass that the Sun and Stars Rise and Set upon.*

Being of excellent Use for readily finding the Variation of the Compass; and may be performed by an ordinary Meridian Compass, but more exactly by an Azimuth Compass.

Fitting all Parts of the World, where the Pole is not elevated above 60 deg. either North or South.

Latitude



Latitude 0 Degree.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d.m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	2.49	1
2	5.37	2
3	8.26	3
ebn wbn	11.15	ebs wbs
1	14.04	1
2	16.52	2
3	19.41	3
ene wnw	22.30	ese wsw

Latitude 1 Degree.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d.m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	2.49	1
2	5.37	2
3	8.26	3
ebn wbn	11.15	ebs wbs
1	14.04	1
2	16.52	2
3	19.41	3
ene wnw	22.30	ese wsw

Latitude 2 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d.m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	2.49	1
2	5.37	2
3	8.26	3
ebn wbn	11.15	ebs wbs
1	14.04	1
2	16.52	2
3	19.40	3
ene wnw	22.29	ese wsw

Latitude 3 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d.m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	2.49	1
2	5.37	2
3	8.25	3
ebn wbn	11.14	ebs wbs
1	14.03	1
2	16.51	2
3	19.39	3
ene wnw	22.27	ese wsw



## Latitude 4 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.48	1
2	5.37	2
3	8.25	3
ebn wbn	11.14	eb s wbs
1	14.02	1
2	16.50	2
3	19.38	3
ene wn w	22.25	ese wsw

## Latitude 5 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.48	1
2	5.36	2
3	8.24	3
ebn wbn	11.12	eb s wbs
1	14.01	1
2	16.49	2
3	19.36	3
ene wn w	22.23	ese wsw

## Latitude 6 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.48	1
2	5.36	2
3	8.23	3
ebn wbn	11.11	eb s wbs
1	13.59	1
2	16.47	2
3	19.32	3
ene wn w	22.21	ese wsw

## Latitude 7 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.48	1
2	5.35	2
3	8.22	3
ebn wbn	11.09	eb s wbs
1	13.57	1
2	16.45	2
3	19.32	3
ene wn w	22.19	ese wsw



Latitude 8 Degrees.

NorthDec.	Dec.	South Dec.
⊙ri   ⊙set	d.m.	⊙ri   ⊙set
East West	0.00	East West
1	2.47	1
2	5.35	2
3	8.21	3
ebn wbn	11.08	ebs wbs
1	13.55	1
2	16.42	2
3	19.29	3
ene wnw	22.16	ese wsw

Latitude 9 Degrees.

NorthDec.	Dec.	South Dec.
⊙ri   ⊙set	d.m.	⊙ri   ⊙set
East West	0.00	East West
1	2.47	1
2	5.33	2
3	8.20	3
ebn wbn	11.06	ebs wbs
1	13.53	1
2	16.40	2
3	19.26	3
ene wnw	22.12	ese wsw

Latitude 10 Degrees.

NorthDec.	Dec.	South Dec.
⊙ri   ⊙set	d.m.	⊙ri   ⊙set
East West	0.00	East West
1	2.46	1
2	5.32	2
3	8.18	3
ebn wbn	11.04	ebs wbs
1	13.50	1
2	16.37	2
3	19.22	3
ene wnw	22.08	ese wsw

Latitude 11 Degrees.

NorthDec.	Dec.	South Dec.
⊙ri   ⊙set	d.m.	⊙ri   ⊙set
East West	0.00	East West
1	2.46	1
2	5.31	2
3	8.17	3
ebn wbn	11.03	ebs wbs
1	13.48	1
2	16.33	2
3	19.18	3
ene wnw	22.03	ese wsw



## Latitude 12 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	2.45	1
2	5.30	2
3	8.15	3
ebn wbn	11.00	eb s wbs
1	13.45	1
2	16.30	2
3	19.14	3
ene wn w	21.58	ese wsw

## Latitude 13 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	2.45	1
2	5.29	2
3	8.13	3
ebn wbn	10.57	eb s wbs
1	13.42	1
2	16.26	2
3	19.10	3
ene wn w	21.52	ese wsw

## Latitude 14 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	2.44	1
2	5.28	2
3	8.11	3
ebn wbn	10.55	eb s wbs
1	13.38	1
2	16.22	2
3	19.04	3
ene wn w	21.47	ese wsw

## Latitude 15 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	2.43	1
2	5.26	2
3	8.09	3
ebn wbn	10.52	eb s wbs
1	13.35	1
2	16.17	2
3	18.59	3
ene wn w	21.41	ese wsw



Latitude 16 Degrees.			Latitude 17 Degrees.		
North Dec.	Dec.	South Dec.	North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet	⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West	East West	0.00	East West
1	2.42	1	1	2.42	1
2	5.25	2	2	5.23	2
3	8.06	3	3	8.04	3
ebn wbn	10.49	eb s wbs	ebn wbn	10.45	eb s wbs
1	13.31	1	1	13.29	1
2	16.12	2	2	16.08	2
3	18.53	3	3	18.47	3
ene wnw	21.34	ese wsw	ene wnw	21.27	ese wsw

Latitude 18 Degrees.			Latitude 19 Degrees.		
North Dec.	Dec.	South Dec.	North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet	⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West	East West	0.00	East West
1	2.41	1	1	2.40	1
2	5.21	2	2	5.19	2
3	8.01	3	3	7.58	3
ebn wbn	10.42	eb s wbs	ebn wbn	10.38	eb s wbs
1	13.22	1	1	13.17	1
2	16.02	2	2	15.56	2
3	18.40	3	3	18.34	3
ene wnw	21.20	ese wsw	ene wnw	21.12	ese wsw



## Latitude 20 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.39	1
2	5.17	2
3	7.55	3
ebn wbn	10.34	ebs wbs
1	13.12	1
2	15.49	2
3	18.27	3
ene wnw	21.04	ese wsw

## Latitude 21 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.38	1
2	5.15	2
3	7.52	3
ebn wbn	10.30	ebs wbs
1	13.07	1
2	15.43	2
3	18.20	3
ene wnw	20.55	ese wsw
1	23.32	1

## Latitude 22 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.37	1
2	5.13	2
3	7.49	3
ebn wbn	10.25	ebs wbs
1	13.01	1
2	15.37	2
3	18.12	3
ene wnw	20.46	ese wsw
2	23.21	1

## Latitude 23 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.36	1
2	5.11	2
3	7.46	3
ebn wbn	10.21	ebs wbs
1	12.56	1
2	15.31	2
3	18.03	3
ene wnw	20.37	ese wsw
1	23.11	1



Latitude 24 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.34	1
2	5.08	2
3	7.42	3
ebn wbn	10.16	ebs wbs
1	12.50	1
2	15.23	2
3	17.55	3
ene wnw	20.27	ese wsw
1	23.00	1

Latitude 25 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.33	1
2	5.06	2
3	7.38	3
ebn wbn	10.11	ebs wbs
1	12.43	1
2	15.15	2
3	17.46	3
ene wnw	20.17	ese wsw
1	22.48	1

Latitude 26 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.32	1
2	5.03	2
3	7.35	3
ebn wbn	10.06	ebs wbs
1	12.36	1
2	15.08	2
3	17.37	3
ene wnw	20.06	ese wsw
1	22.36	1

Latitude 27 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.30	1
2	5.00	2
3	7.31	3
ebn wbn	10.01	ebs wbs
1	12.30	1
2	15.00	2
3	17.28	3
ene wnw	19.55	ese wsw
1	22.23	1



## Latitude 28 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	2.29	1
2	4.58	2
3	7.27	3
e b n w b n	9.55	e b s w b s
1	12.23	1
2	14.51	2
3	17.18	3
e n e w n w	19.44	e s e w s w
1	22.11	1

## Latitude 29 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.50	East West
1	2.28	1
2	4.55	2
3	7.22	3
e b n w b n	9.50	e b s w b s
1	12.16	1
2	14.43	2
3	17.08	3
e n e w n w	19.32	e s e w s w
1	21.58	1

## Latitude 30 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	2.27	1
2	4.52	2
3	7.18	3
e b n w b n	9.44	e b s w b s
1	12.09	1
2	14.34	2
3	16.57	3
e n e w n w	19.20	e s e w s w
1	21.44	1

## Latitude 31 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	2.25	1
2	4.50	2
3	7.13	3
e b n w b n	9.38	e b s w b s
1	12.01	1
2	14.25	2
3	16.47	3
e n e w n w	19.08	e s e w s w
1	21.30	1



Latitude 32 Degrees.

Latitude 33 Degrees.

North Dec.		Dec.	South Dec.		North Dec.		Dec.	South Dec.	
Ori	Ofet	d. m.	Ori	Ofet	Ori	Ofet	d. m.	Ori	Ofet
East	West	0.00	East	West	East	West	0.00	East	West
1		2.33	1		1		2.22	1	
2		4.46	2		2		4.43	2	
3		7.08	3		3		7.04	3	
ebn wbn		9.31	ebs wbs		ebn wbn		9.25	ebs wbs	
1		11.54	1		1		11.46	1	
2		14.15	2		2		14.06	2	
3		16.36	3		3		16.24	3	
ene wnw		18.55	ese wsw		ene wnw		18.43	ese wsw	
1		21.16	1		1		21.01	1	
					2		23.17	2	

Latitude 34 Degrees.

Latitude 35 Degrees.

North Dec.		Dec.	South Dec.		North Dec.		Dec.	South Dec.	
Ori	Ofet	d. m.	Ori	Ofet	Ori	Ofet	d. m.	Ori	Ofet
East	West	0.00	East	West	East	West	0.00	East	West
1		2.20	1		1		2.18	1	
2		4.40	2		2		4.37	2	
3		6.59	3		3		6.54	3	
ebn wbn		9.18	ebs wbs		ebn wbn		9.12	ebs wbs	
1		11.38	1		1		11.29	1	
2		13.56	2		2		13.46	2	
3		16.13	3		3		16.02	3	
ene wnw		18.29	ese wsw		ene wnw		18.16	ese wsw	
1		20.46	1		1		20.30	1	
2		23.00	2		2		22.43	2	



## Latitude 36 Degrees.

North Dec.	Dec.	South Dec.
☉ ri   ☉ set	d. m.	☉ ri   ☉ set
East West	0.00	East West
1	2.16	1
2	4.33	2
3	6.49	3
e b n w b n	9.05	e b s w b s
1	11.20	1
2	13.35	2
3	15.49	3
e n e w n w	18.02	e s e w s w
1	20.15	1
2	22.25	2

## Latitude 37 Degrees.

North Dec.	Dec.	South Dec.
☉ ri   ☉ set	d. m.	☉ ri   ☉ set
East West	0.00	East West
1	2.15	1
2	4.30	2
3	6.43	3
e b n w b n	8.58	e b s w b s
1	11.12	1
2	13.25	2
3	15.36	3
e n e w n w	17.47	e s e w s w
1	19.58	1
2	22.07	2

## Latitude 38 Degrees

North Dec.	Dec.	South Dec.
☉ ri   ☉ set	d. m.	☉ ri   ☉ set
East West	0.00	East West
1	2.13	1
2	4.26	2
3	6.38	3
e b n w b n	8.50	e b s w b s
1	11.03	1
2	13.14	2
3	15.23	3
e n e w n w	17.32	e s e w s w
1	19.41	1
2	21.49	2

## Latitude 39 Degrees.

North Dec.	Dec.	South Dec.
☉ ri   ☉ set	d. m.	☉ ri   ☉ set
East West	0.00	East West
1	2.11	1
2	4.22	2
3	6.32	3
e b n w b n	8.43	e b s w b s
1	10.53	1
2	13.03	2
3	15.10	3
e n e w n w	17.17	e s e w s w
1	19.25	1
2	21.30	2
3	23.32	3



Latitude 40 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0 00	East West
1	2.09	1
2	4.19	2
3	6.27	3
ebn wbn	8.36	ebs wbs
1	10.43	1
2	12.51	2
3	14.57	3
ene wnw	17.02	ese wsw
1	19.07	1
2	21.10	2
3	23.11	3

Latitude 41 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.07	1
2	4.15	2
3	6.22	3
ebn wbn	8.28	ebs wbs
1	10.34	1
2	12.40	2
3	14.44	3
ene wnw	16.47	ese wsw
1	18.50	1
2	20.51	2
3	22.50	3

Latitude 42 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.05	1
2	4.11	2
3	6.16	3
ebn wbn	8.20	ebs wbs
1	10.24	1
2	12.28	2
3	14.30	3
ene wnw	16.31	ese wsw
1	18.32	1
2	20.31	2
3	22.27	3

Latitude 43 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.03	1
2	4.07	2
3	6.10	3
ebn wbn	8.12	ebs wbs
1	10.14	1
2	12.16	2
3	14.16	3
ene wnw	16.15	ese wsw
1	18.14	1
2	20.10	2
3	22.05	3



## Latitude 44 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.01	1
2	4.03	2
3	6.04	3
ebn wbn	8.04	ebs wbs
1	10.04	1
2	12.03	2
3	14.01	3
ene wnw	15.59	ese wsw
1	17.54	1
2	19.50	2
3	21.42	3
nebenwbw	23.34	sebe swbw

## Latitude 45 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	2.00	1
2	3.59	2
3	5.57	3
ebn wbn	7.56	ebs wbs
1	9.54	1
2	11.51	2
3	13.46	3
ene wnw	15.42	ese wsw
1	17.36	1
2	19.28	2
3	21.19	3
nebenwbw	23.08	sebe swbw

## Latitude 46 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	ri   O set
East West	0.00	East West
1	1.58	1
2	3.55	2
3	5.51	3
ebn wbn	7.47	ebs wbs
1	9.43	1
2	11.38	2
3	13.32	3
ene wnw	15.25	ese wsw
1	17.17	1
2	19.07	2
3	20.55	3
nebenwbw	22.42	sebe swbw

## Latitude 47 Degrees.

North Dec.	Dec.	South Dec.
Ori   O set	d. m.	Ori   O set
East West	0.00	East West
1	1.55	1
2	3.50	2
3	5.45	3
ebn wbn	7.39	ebs wbs
1	9.33	1
2	11.25	2
3	13.17	3
ene wnw	15.07	ese wsw
1	16.57	1
2	18.45	2
3	20.31	3
nebenwbw	22.16	sebe swbw



Latitude 48 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	1.53	1
2	3.46	2
3	5.38	3
ebn wbn	7.30	eb s wbs
1	9.22	1
2	11.12	2
3	13.01	3
ene wnw	14.50	ese wsw
1	16.38	1
2	18.24	2
3	20.07	3
nebenwbw	21.49	sebe swbw
1	23.29	1

Latitude 49 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	1.51	1
2	3.42	2
3	5.31	3
ebn wbn	7.22	eb s wbs
1	9.10	1
2	10.59	2
3	12.46	3
ene wnw	14.32	ese wsw
1	16.17	1
2	18.01	2
3	19.42	3
nebenwbw	21.22	sebe swbw
1	23.01	1

Latitude 50 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	1.48	1
2	3.37	2
3	5.25	3
ebn wbn	7.12	eb s wbs
1	8.59	1
2	10.46	2
3	12.30	3
ene wnw	14.14	ese wsw
1	15.57	1
2	17.39	2
3	19.18	3
nebenwbw	20.55	sebe swbw
1	22.31	1

Latitude 51 Degrees.

North Dec.	Dec.	South Dec.
Ori   O fet	d. m.	Ori   O fet
East West	0.00	East West
1	1.46	1
2	3.33	2
3	5.18	3
ebn wbn	7.04	eb s wbs
1	8.48	1
2	10.32	2
3	12.14	3
ene wnw	13.56	ese wsw
1	15.36	1
2	17.16	2
3	18.52	3
nebenwbw	20.28	sebe swbw
1	22.01	1
2	23.32	2



## Latitude 52 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	1.44	1
2	3.27	2
3	5.11	3
ebn wbn	6.54	ebs wbs
1	8.36	1
2	10.18	2
3	11.58	3
ene wnwn	13.37	ese wsw
1	15.16	1
2	16.52	2
3	18.27	3
nebenwbw	20.00	sebe swbw
1	21.31	1
2	23.00	2

## Latitude 53 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	1.42	1
2	3.23	2
3	5.04	3
ebn wbn	6.44	ebs wbs
1	8.25	1
2	10.04	2
3	11.42	3
ene wnwn	13.19	ese wsw
1	14.55	1
2	16.29	2
3	18.01	3
nebenwbw	19.32	sebe swbw
1	21.01	1
2	22.27	2

## Latitude 54 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	1.39	1
2	3.18	2
3	4.57	3
ebn wbn	6.35	ebs wbs
1	8.13	1
2	9.50	2
3	11.25	3
ene wnwn	13.00	ese wsw
1	14.33	1
2	16.05	2
3	17.35	3
nebenwbw	19.05	sebe swbw
1	20.30	1
2	21.54	2
3	23.15	3

## Latitude 47 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri   ⊙ fet	d. m.	⊙ ri   ⊙ fet
East West	0.00	East West
1	1.37	1
2	3.13	2
3	4.49	3
ebn wbn	6.25	ebs wbs
1	8.01	1
2	9.35	2
3	11.08	3
ene wnwn	12.41	ese wsw
1	14.12	1
2	15.42	2
3	17.09	3
nebenwbw	18.35	sebe swbw
1	19.59	1
2	21.21	2
3	22.39	3



Latitude 56 Degrees.

Latitude 57 Degrees.

North Dec		Decl.	South Dec.		North Dec		Decl.	South Dec.	
Ori	Ofet	d. m.	Ori	Ofet	Ori	Ofet	d. m.	Ori	Ofet
East	West	0.00	East	West	East	West	0.00	East	West
1		1.34	1		1		1.32	1	
2		3.09	2		2		3.04	2	
3		4.42	3		3		4.35	3	
ebn wbn		6.16	eb s wbs		ebn wbn		6.06	eb s wbs	
1		7.49	1		1		7.36	1	
2		9.21	2		2		9.06	2	
3		10.51	3		3		10.34	3	
ene wnw		12.22	ese wsw		ene wnw		12.01	ese wsw	
1		13.50	1		1		13.28	1	
2		15.18	2		2		14.53	2	
3		16.42	3		3		16.16	3	
nebe nwbw		18.06	sebe swbw		nebe nwbw		17.37	sebe swbw	
1		19.28	1		1		18.56	1	
2		20.47	2		2		20.13	2	
3		22.03	3		3		21.27	3	
nenw		23.18	se sw		nenw		22.39	se sw	

Latitude 58 Degrees.

Latitude 59 Degrees.

East		West	East		West	East		West	East		West
		0.00						0.00			
1		1.30	1			1		1.27	1		
2		2.59	2			2		2.54	2		
3		4.28	3			3		4.20	3		
ebn wbn		5.56	eb s wbs			ebn wbn		5.46	eb s wbs		
1		7.24	1			1		7.11	1		
2		8.51	2			2		8.36	2		
3		10.17	3			3		10.00	3		
ene wnw		11.42	ese wsw			ene wnw		11.22	ese wsw		
1		13.06	1			1		12.44	1		
2		14.28	2			2		14.03	2		
3		15.48	3			3		15.21	3		
nebe nwbw		17.07	sebe swbw			nebe nwbw		16.37	sebe swbw		
1		18.24	1			1		17.52	1		
2		19.39	2			2		19.04	2		
3		20.51	3			3		20.14	3		
nenw		22.00	se sw			nenw		21.22	se sw		
1		23.08	1			1		22.26	1		
						2		23.27	2		



## Latitude 60 Degrees.

North Declination.			South Declination.		
☉ rise	D. M.	☉ set	☉ rise	D. M.	☉ set
East	0.00	West	East	0.00	West
1	1.25	1	1	1.25	1
2	2.49	2	2	2.49	2
3	4.12	3	3	4.12	3
e by n	5.36	w by n	e by s	5.36	w by s
1	6.59	1	1	6.59	1
2	8.21	2	2	8.21	2
3	9.42	3	3	9.42	3
e n e	11.02	w n w	e s e	11.02	w s w
1	12.21	1	1	12.21	1
2	13.38	2	2	13.38	2
3	14.53	3	3	14.53	3
n e by e	16.08	n w by w	s e by e	16.08	s w by w
1	17.20	1	1	17.20	1
2	18.30	2	2	18.30	2
3	19.38	3	3	19.38	3
n e	20.42	n w	s e	20.42	s w
1	21.45	1	1	21.45	1
2	22.44	2	2	22.44	2

*The Description and Use of the foregoing TABLES.*

1. **T**H E S E Tables of the Points of the Compass, (for the Sun, or any Star whose Declination exceeds not 23 deg. 29 min.) begin at Latitude 0 deg. and proceed orderly to 60 deg. (being some four, some two Tables, in one Page) and sixty-one in all.

2. In each Table are five Columns; the middlemost contains the Degrees of Declination, either North or South; those two on each Side of it, mark'd ☉ rise, ☉ set (under *North* or *South Declination*) stand for Sun-rising and Sun-setting.

3. The



3. The first and second Columns (under *North Declination*) as also the fourth and fifth Columns under *South Declination*) contain the Points, and each Quarter of a Point of the Compass, of both Rising and Setting: Thus, *East, West*, under which is 1, 2, 3; that is *East* or *West* 1 Quarter, 2 Quarters, 3 Quarters, *Northerly* or *Southerly*; then E. by N. W. by N. under which is 1, 2, 3; that is, E. by N. or W. by N. 1 Quarter, 2 Quarters *Northerly*, &c.

These Tables are ready Helps for finding the Variation of the Compass with Ease and sufficient Exactness; as is evident from the following Explanation.

*To find the Point of the Compass that the Sun riseth or setteth with, at any Time of the Year.*

**FIRST**, seek the Sun's Declination, in the Table of Declination for the Time proposed; with which enter the foregoing Table, finding the Latitude in the Head of the Table, and the Declination in the third Column; against which, on the Left-hand, if it be North Declination, but on the Right-hand if it be South Declination, is the Point of the Compass that the Sun rises or sets at, according to the Titles at the Head of the Table.

*Note*, These Tables shew the true Points of the Sun's Rising or Setting; so that you may readily know at any Time, seeing the Sun rise or set, the Variation by an ordinary Meridian Compass.

There are some Compasses not touched so well as they ought to be; others in Time will grow weak, or lose their magnetic Virtue.

Now by these foregoing Tables you may very readily discover any of these Defects.

It may indeed be objected, they cannot see the Sun by an ordinary Meridian Compass, so near as is required.



To this I answer, it's as easy to set the Sun by the Compass, as to steer a Ship by it; for expert Seamen can set the Sun, or a Headland, to near a Quarter of a Point by their Hand, (but with Sights much nearer the Truth.) The Posture to observe in such a Case, I advise, is thus;

Set the Compass about two Feet high, and directing your Hand towards the Sun, note what Point, Half-point, or Quarter-point, the Sun riseth, or setteth on; then in that Table belonging to the Latitude, see whether the Sun riseth or sets that Day upon the same Point, found by Observation; if they agree, there is no Variation; but if they do not agree, the Compass is not true, or theree is Variation; and the Variation is so much, as is the Difference between the Observation and the Table.

*Example 1.* Admit in Latitude 30 Degrees North, the Sun having 9 Degrees 43 Minutes North Declination; I observe the Sun that Day to rise upon the E.N.E. Point of the Compass. I demand the Variation?

In the Head of the foregoing Tables, look for the Latitude 30 Degrees; and in the third Column for 9 deg. 43 min. North Declination; and against it (under ☉ rise) is E. by N. which sheweth that there is one Point Variation. For it appears by the Table, that the E.N.E. Point on the Compass is the true E. by N. Point; and the E. by N. (as it's upon the Compass) is the true E. Point; the East Point is the true E. by S. the S.E. is the S.E. by S. and the South is the S. by W. the West is the W. by N. and the North is the N. by E.

This plainly appears by the *Rectifier*, if you bring the E. by N. on the outward Circle, right against the E.N.E. on the inward Circle.

Now suppose we were to observe the Sun at his Setting, in the Latitude of 30 deg. with Declination 9 deg. 43 min. North as abovesaid, we should find the Sun to set exactly at West by the Compass, although in the Morning



Morning we did find the Sun to rise at E.N.E. I know this will be little less than a Contradiction to some; but if you cast your Eye upon the *Rectifier*, you may see it's a certain Truth.

*Example 2.* In Latitude 37 deg. North, the Sun's Declination 8 deg. 58 min. North, I observe the Sun to rise E. by N. by the Compass: I demand the Variation?

In the Table that belongs to 37 deg. against 8 deg. 58 min. North Declination, and under Rise is E. by N. which sheweth there is no Variation, because the Observation agreeth with the Table.

*Note,* If the Declination for the Day proposed be not the same with the Declination in the Tables, then have Regard to the nearest, allowing for the Difference, by the Rule of Proportion.

*Example 3.* In the Latitude 37 deg. North, suppose the Sun's Declination 10 deg 15 min. North, I demand the Point of the Compass the Sun then riseth upon?

In the Tables nearest to 10 deg. 15 min. is 11 deg. 12 min. against which the Sun riseth E. by N. a quarter N. and sets W. by N. a quarter N. but in the Table for 37 deg. Latitude, the Declination proposed, is near about the middle, between 8 deg. 58 min. and 11 deg. 12 min. Therefore the Sun riseth E. by N. half a quarter N. and setteth W. by N. half a quarter N.

Understand the like in any other Case, let the Declination be what it will, and in any other Latitude.

*Example 4.* Admit in Latitude 38d. 20m. North, and Declination 19d. 50m. South: The Sun riseth upon the E.S.E. Point of the Compass: I demand the Variation?

In the Table for Latitude 38 deg. and against 19 deg. 41 min. (the nearest to the given Declination) is E.S.E. a quarter S. which sheweth that there is a quarter of a Point Variation. For the E.S.E. Point is E.S.E. a quarter S. and the North Point is N. a quarter E. For, if you bring ESE. a quarter S. on the outward Circle of the *Rectifier* right against E.S.E. on the inward Circle, then SSW. on the



Compass is SSW. a quarter W. and SE. is SE. a quarter S. and E. is E. a quarter S. And so for any other Point, Half-point, or Quarter-point, by casting your Eye upon the *Rectifier*.

*Note,* These Tables shew the true Points of Rising and Setting, and the outward Circle on the *Rectifier* doth the same; but the Compass, when it differeth from the Tables, shews a false Point; and the inward Circle on the *Rectifier* doth the same.

*Example 5.* Admit in Latitude 47d. 24m. North, the Declination 15d. 2m. South, the Sun-rising E. by S. by the Compass; I demand the Variation?

By the Tables the Sun should rise E S.E. therefore there is one Point Variation: For if you bring the E.S.E. on the outward Circle of the *Rectifier*, over against the E. by S. on the inward Circle, then the N. by W. on the Compass is the true North Point; the N.W. is the N.W. by N. and the S. by E. is the true South Point.

By this Time I suppose my Reader able to discover how much the Variation is, and how to reckon it without any Geometric Demonstration, or Arithmetic Calculation.

*Note,* If you have any odd Minutes of Latitude, go to that Table nearest the Latitude you are in.

I come now to resolve a Question which some are puzzled with; and that is this:

*Quest.* If the Sun rise at E.N.E. by any Compass in any Latitude, should not he set the same Day at W.N.W. by the same Compass, and in the same Latitude?

*Answ.* If there be no Variation he will; but if there be Variation, he will not. The Reason is evident by the *Rectifier*.

By these Tables you may know upon what Point of the Compass any of the Stars rise and set in any Latitude the Tables contain, either North or South, if the Declination do not exceed the Sun's greatest Declination.

*Example 6.* Let it be required to find the Points of the Compass the *Bull's Eye* rises and sets with, in the Latitude of 50 deg. North.



The Declination of this Star is 16 deg. North ; in the Table that belongs to 50d. against 16 deg. North Declination, the true Point of Rising is E.N.E. a quarter N. and the true Point of Setting W.N.W. a quarter N.

Understand the like for any other Star, whose Declination doth not exceed the Sun's greatest Declination.

*The Use of the RECTIFIER.*

**T**HIS Instrument, as before described, (in Pages 93, 94, and 95,) containeth two Circles or Compasses, one within the other ; but as 'tis made of Wood, the one moves upon the other, and by it the Compass, when it varies may be rectified as follows :

Bring the true Point of Rising or Setting (as the Table sheweth) on the outward or under Compass, right against the false Point of Rising and Setting (as your Compass sheweth) on the inward or upper Compass ; then will the under Compass rectify the upper.

*Example 7.* Admit in Lat. 45d. N. the Sun's Declination being 7d. 56m. South, the Sun setting upon the W. by N. Point of the Compass, I demand the Variation ?

The Sun, if there be no Variation, will set at W. by S. and rise at E. by S. as appears from the Table ; therefore it is plain that there are two Points Variation.

Bring the W. by S. Point on the outward Compass, right against the W. by N. Point on the inward Compass ; then the Points upon the outward Compass explain the Points that are upon the inward ; so that according to the foregoing Observation, the N.N.E. Point on the Compass is the true North : The North is the true N.N.W. the W. by N. is the true W. by S. the S.E. by E. is the true E. by S. And so for any other Point of the Compass, by only looking on the *Rectifier*.

And thus you may rectify the Compass, without reckoning which way the Variation is, either Eastward or Westward : The *Rectifier* doing it so plain, that you can't be mistaken.



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	1		2		3		4		5		6	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	00	01	00	01	00	01	00	01	00	01	00
2	02	00	02	00	02	00	02	00	02	00	02	00
3	03	00	03	00	03	00	03	00	03	00	03	01
4	04	00	04	00	04	00	04	00	04	01	04	01
5	05	00	05	00	05	00	05	00	05	01	05	01
6	06	00	06	00	06	00	06	01	06	01	06	02
7	07	00	07	00	07	00	07	01	07	01	07	02
8	08	00	08	00	08	01	08	01	08	02	08	02
9	09	00	09	00	09	01	09	01	09	02	09	02
10	10	00	10	00	10	01	10	01	10	02	10	03
11	11	00	11	00	11	01	11	01	11	02	11	03
12	12	00	12	00	12	01	12	01	12	03	12	04
13	13	00	13	00	13	01	13	01	13	03	13	04
14	13	00	14	00	14	01	14	02	14	03	14	04
15	15	00	15	00	15	01	15	02	15	03	15	05
16	16	00	16	01	16	01	16	02	16	04	16	05
17	17	00	17	01	17	01	17	02	17	04	17	05
18	18	00	18	01	18	01	18	02	18	04	18	06
19	19	00	19	01	19	01	19	02	19	04	19	06
20	20	00	20	01	20	02	20	03	20	05	20	06
21	21	00	21	01	21	02	21	03	21	05	21	07
22	22	00	22	01	22	02	22	03	22	05	22	07
23	23	00	23	01	23	02	23	03	23	05	23	08
23, 29	23	22	23	30	23	31	23	33	23	35	23	37



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	7		8		9		10		11		12	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	00	01	00	01	00	01	01	01	01	01	01
2	02	01	02	01	02	01	02	02	02	02	02	03
3	03	01	03	01	03	01	03	03	03	03	03	04
4	04	02	04	02	04	02	04	04	04	04	04	05
5	05	02	05	02	05	03	05	05	05	05	05	07
6	06	02	06	03	06	04	06	06	06	06	06	08
7	07	03	07	04	07	05	07	07	07	08	07	09
8	08	03	08	04	08	06	08	08	08	09	08	11
9	09	04	09	05	09	06	09	09	09	10	09	12
10	10	04	10	06	10	07	10	10	10	11	10	13
11	11	05	11	06	11	08	11	11	11	13	11	15
12	12	05	12	07	12	09	12	12	12	14	12	16
13	13	06	13	08	13	09	13	13	13	15	13	17
14	14	06	14	08	14	10	14	14	14	16	14	19
15	15	07	15	09	15	11	15	15	15	17	15	20
16	16	07	16	10	16	12	16	16	16	19	16	22
17	17	08	17	10	17	13	17	17	17	20	17	23
18	18	08	18	11	18	14	18	18	18	21	18	25
19	19	09	19	12	19	15	19	19	19	22	19	26
20	20	09	20	12	20	16	20	20	20	24	20	28
21	21	10	21	13	21	17	21	21	21	25	21	29
22	22	10	22	13	22	18	22	22	22	27	02	31
23	23	11	23	14	23	19	23	23	23	28	23	33
23, 29	23	40	23	45	23	50	23	54	23	59	24	05

Degrees of Declination.



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	13		14		15		16		17		18	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	02	01	02	01	02	01	02	01	02	01	03
2	02	03	02	04	02	04	02	05	02	05	02	06
3	03	05	03	05	03	06	03	07	03	08	03	09
4	04	06	04	07	04	08	04	10	04	11	04	12
5	05	08	05	09	05	10	05	12	05	13	05	15
6	06	10	06	11	06	13	06	15	06	17	06	19
7	07	11	07	13	07	15	07	17	07	19	07	22
8	08	13	08	15	08	17	08	19	08	22	08	25
9	09	14	09	17	09	19	09	21	09	25	09	28
10	10	16	10	19	10	21	10	24	10	28	10	31
11	11	17	11	20	11	23	11	27	11	30	11	34
12	12	19	12	22	12	25	12	29	12	33	12	38
13	13	20	13	24	13	27	13	32	13	36	13	41
14	14	22	14	26	14	30	14	34	14	39	14	44
15	15	24	15	28	15	32	15	37	15	42	15	47
16	16	26	16	30	16	35	16	40	16	45	16	51
17	17	28	17	32	17	37	17	42	17	48	17	54
18	18	30	18	34	18	39	18	45	18	51	18	58
19	19	31	19	36	19	42	19	48	19	54	20	01
20	20	33	20	38	20	44	20	51	20	57	21	04
21	21	35	21	40	21	46	21	53	22	00	22	08
22	22	37	22	43	22	49	22	56	23	04	23	12
23	23	39	23	45	23	51	23	58	24	06	24	15
23 29	24	11	24	16	24	24	24	32	24	40	24	49



*A T A B L E of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	19		20		21		22		23		24	
	D. M.		D. M.		D. M.		D. M.		D. M.		D. M.	
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	03	01	04	01	04	01	05	01	05	01	06
2	02	07	02	08	02	08	02	09	02	10	02	12
3	03	10	03	12	03	13	03	14	03	15	03	37
4	04	14	04	16	04	17	04	19	04	21	04	23
5	05	17	05	19	05	21	05	23	05	26	05	28
6	06	21	06	23	06	26	06	28	06	31	06	34
7	07	24	07	27	07	30	07	33	07	37	07	40
8	08	28	08	31	08	34	08	38	08	42	08	46
9	09	31	09	35	09	39	09	43	09	47	09	51
10	10	35	10	39	10	43	10	48	10	52	10	57
11	11	38	11	43	11	48	11	53	11	58	12	03
12	12	42	12	47	12	52	12	58	13	03	13	09
13	13	46	13	51	13	57	14	03	14	09	14	15
14	14	50	14	55	15	01	15	08	15	14	15	21
15	15	53	16	00	16	06	16	13	16	20	16	27
16	16	57	17	04	17	11	17	18	17	26	17	34
17	18	01	18	08	18	15	18	23	18	31	18	40
18	19	05	19	12	19	20	19	28	19	37	19	46
19	20	08	20	16	20	24	20	33	20	42	20	52
20	21	12	21	20	21	29	21	39	21	49	21	59
21	22	16	22	25	22	34	22	44	22	55	23	07
22	23	20	23	29	23	39	23	50	24	01	24	12
23	24	24	24	54	24	44	24	55	25	07	25	19
23, 29	24	58	25	08	25	18	25	29	25	41	25	54

Degrees of Declination.



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	25		26		27		28		29		30	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	06	01	07	01	08	01	03	01	09	01	09
2	02	12	02	13	02	15	02	16	02	17	02	18
3	03	18	03	20	03	22	03	24	03	26	03	28
4	04	25	04	27	04	29	04	32	04	34	04	37
5	05	31	05	33	05	37	05	40	05	43	05	46
6	06	37	06	41	06	44	06	48	06	52	06	56
7	07	43	07	48	07	51	07	56	08	01	08	06
8	08	50	08	54	08	59	09	04	09	09	09	15
9	09	56	10	01	10	06	10	12	10	18	10	24
10	11	03	11	08	11	14	11	21	11	27	11	34
11	12	09	12	15	12	21	12	28	12	36	12	44
12	13	16	13	23	13	30	13	37	13	45	13	53
13	14	22	14	30	14	37	14	45	14	54	15	03
14	15	29	15	37	15	45	15	54	16	03	16	12
15	16	35	16	44	16	53	17	03	17	12	17	23
16	17	42	17	51	18	01	18	11	18	21	18	32
17	18	49	18	59	19	09	19	20	19	31	19	43
18	19	56	20	06	20	17	20	29	20	41	20	54
19	21	02	21	13	21	25	21	38	21	51	22	05
20	22	10	22	22	22	34	22	48	23	02	23	16
21	23	18	23	30	23	43	23	57	24	12	24	27
22	24	24	24	37	24	51	25	06	25	22	25	38
23	25	32	25	46	26	01	26	16	26	32	26	49
23, 29	26	08	26	23	26	37	26	52	27	08	27	25



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	31		32		33		34		35		36	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	10	01	10	01	11	01	12	01	13	01	14
2	03	19	02	21	02	23	02	25	02	27	02	29
3	03	30	03	33	03	35	03	38	03	40	03	43
4	04	40	04	43	04	46	04	50	04	53	04	57
5	05	50	05	54	05	58	06	02	06	06	06	11
6	07	00	07	05	07	10	07	15	07	20	07	25
7	08	11	08	16	08	21	08	27	08	33	08	40
8	09	21	09	27	09	33	09	39	09	46	09	54
9	10	31	10	38	10	45	10	52	11	00	11	08
10	11	41	11	48	11	55	12	05	12	12	12	21
11	12	52	13	00	13	09	13	18	13	28	13	39
12	14	02	14	11	14	21	14	32	14	43	14	54
13	15	13	15	23	15	33	15	44	15	56	16	09
14	16	22	16	33	16	45	16	57	17	10	17	24
15	17	34	17	46	17	58	18	11	18	25	18	40
16	18	44	18	57	19	11	19	25	19	40	19	55
17	19	56	20	10	20	24	20	39	20	55	21	11
18	21	07	21	21	21	36	21	55	22	10	22	27
19	22	19	22	34	22	50	23	07	23	25	23	44
20	23	31	23	47	24	04	24	22	24	41	25	00
21	24	43	25	00	25	18	25	37	25	56	26	17
22	25	55	26	13	26	32	26	52	27	13	27	35
23	27	07	27	26	27	46	28	07	28	29	28	52
23, 29	27	43	28	03	28	23	28	45	29	05	29	22

Degrees of Declination.



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude either North or South.*

The Degrees of Latitude.

Sun's Declin.	37		38		39		40		41		42	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	15	01	16	01	17	01	18	01	20	01	21
2	02	30	02	32	02	34	02	36	02	39	02	41
3	03	45	03	48	03	51	03	54	03	58	04	02
4	05	00	05	04	05	08	05	13	05	18	05	23
5	06	16	06	21	06	26	06	32	06	38	06	44
6	07	31	07	37	07	43	07	50	07	57	08	05
7	08	47	08	54	09	01	09	09	09	17	09	26
8	10	02	10	10	10	19	10	28	10	37	10	47
9	11	17	11	27	11	37	11	47	11	58	12	09
10	12	32	12	43	12	54	13	06	13	18	13	31
11	13	00	14	01	14	13	14	26	14	39	14	53
12	15	06	15	18	15	31	15	45	16	00	16	15
13	16	22	16	35	16	49	17	04	17	20	17	37
14	17	38	17	52	18	08	18	24	18	42	19	00
15	18	55	19	11	19	28	19	45	20	04	20	23
16	20	11	20	28	20	46	21	05	21	25	21	46
17	21	28	21	46	22	06	22	26	22	48	23	10
18	22	48	23	05	23	25	23	47	24	10	24	34
19	24	04	24	24	24	46	25	09	25	33	25	58
20	25	21	25	43	26	06	26	30	26	56	27	24
21	26	39	27	02	27	27	27	53	28	21	28	50
22	27	58	28	23	28	49	29	16	29	45	30	16
23	29	17	29	43	30	11	30	40	31	11	31	43
23, 29	29	58	30	24	30	52	31	22	31	54	32	28



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	43		44		45		46		47		48	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	22	01	23	01	25	01	26	01	28	01	29
2	02	44	02	47	02	50	02	53	02	56	02	59
3	04	06	04	10	04	15	04	19	04	24	04	29
4	05	28	05	34	05	40	05	46	05	52	05	59
5	06	51	06	58	07	05	07	12	07	20	07	29
6	08	13	08	21	08	30	08	39	08	49	08	59
7	09	35	09	45	09	56	10	06	10	18	10	30
8	10	58	11	09	11	21	11	34	11	47	12	00
9	12	21	12	34	12	47	13	01	13	16	13	31
10	13	44	13	58	14	13	14	28	14	44	15	02
11	15	07	15	22	15	38	15	56	16	15	16	34
12	16	31	16	48	17	06	17	25	17	45	18	06
13	17	55	18	13	18	33	18	54	19	16	19	39
14	19	18	19	39	20	00	20	23	20	47	21	12
15	20	43	21	05	21	28	21	52	22	18	22	45
16	22	08	22	32	22	56	23	23	23	50	24	20
17	23	34	23	59	24	25	24	53	25	23	25	55
18	24	59	25	26	25	54	26	25	26	57	27	31
19	26	25	26	54	27	25	27	58	28	32	29	07
20	27	53	28	23	28	56	29	31	30	07	30	45
21	29	20	29	53	30	27	31	03	31	42	32	23
22	30	48	31	22	31	58	32	37	33	18	34	03
23	32	16	32	51	33	30	34	12	34	56	35	43
24, 29	33	03	33	40	34	20	35	03	35	48	36	35

Degrees of Declination.



*A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude either North or South.*

The Degrees of Latitude.

Sun's Declin.	49		50		51		52		53		54	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	31	01	33	01	35	01	37	01	39	01	42
2	03	03	03	06	03	10	03	15	03	20	03	24
3	04	34	04	40	04	46	04	52	04	59	05	06
4	06	06	06	14	06	22	06	30	06	39	06	49
5	07	38	07	48	07	58	08	08	08	19	08	31
6	09	42	09	21	09	33	09	46	10	00	10	15
7	10	14	10	55	11	09	11	24	11	40	11	57
8	12	47	12	29	12	45	13	02	13	21	13	41
9	13	00	14	05	14	24	14	43	15	04	15	26
10	15	21	15	40	16	01	16	23	16	46	17	11
11	16	54	17	16	17	39	18	03	18	29	18	57
12	18	28	18	52	19	18	19	44	20	12	20	43
13	20	03	20	29	20	57	21	26	21	57	22	30
14	21	38	22	06	22	37	23	08	23	42	24	18
15	23	14	23	45	24	18	24	52	25	28	26	07
16	24	51	25	24	25	59	26	36	27	16	27	58
17	26	28	27	03	27	41	28	21	29	04	29	50
18	28	06	28	43	29	24	30	07	30	53	31	42
19	29	45	30	25	31	08	31	55	32	45	33	38
20	31	25	32	08	32	54	33	44	34	39	35	35
21	33	06	33	52	34	41	35	34	36	3	37	32
22	34	48	35	37	36	30	37	27	38	29	39	26
23	36	33	37	26	38	23	39	24	40	29	41	40
23, 29	37	26	38	20	39	19	40	23	41	29	42	46



*A TABLE of Amplitudes, fitting all Places from the Equater, to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Sun's Declin.	55		56		57		58		59		60	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	45	01	47	01	50	01	53	01	56	02	00
2	03	29	03	34	03	40	03	46	03	53	04	00
3	05	14	05	22	05	31	05	40	05	50	06	00
4	06	59	07	10	07	22	07	34	07	47	08	01
5	08	44	08	57	09	11	09	26	09	43	10	02
6	10	30	10	47	11	04	11	22	11	42	12	04
7	12	15	12	35	12	56	13	18	13	41	14	06
8	14	02	14	24	14	48	15	14	15	41	16	10
9	15	49	16	14	16	45	17	10	17	41	18	14
10	17	37	18	05	18	33	19	07	19	41	20	18
11	19	26	19	56	20	29	21	04	21	43	22	26
12	21	15	21	49	22	25	23	04	23	47	24	34
13	23	05	23	43	24	23	25	07	25	54	26	44
14	24	56	25	37	26	21	27	09	28	01	28	55
15	26	49	27	34	28	22	29	14	30	12	31	09
16	28	43	29	32	30	24	31	21	32	22	33	27
17	30	39	31	31	32	27	33	28	34	32	35	47
18	32	35	33	33	34	34	35	40	36	53	38	09
19	34	35	35	36	36	46	37	54	39	13	40	36
20	36	36	37	42	38	53	40	12	41	37	43	10
21	38	39	39	51	41	09	42	34	44	05	45	48
22	40	47	42	04	43	27	44	59	46	40	48	32
23	42	56	44	19	45	50	47	30	49	21	51	23
23, 29	44	00	45	27	47	02	48	46	50	42	52	51



*The Use of these Tables of Amplitudes.*

**T**HE Sun or Star's Amplitude, is the Distance of the Rising or Setting of the Sun or Star from the East or West Points of the Horizon, in Degrees and Minutes, reckoned in the Horizon; either Northerly or Southerly.

*Note,* When the Sun or Star's have North Declination they rise to the Northward of the East, and set to the Northward of the West; But if their Declination be South, they rise to the Southward of the East, and set to the Southward of the West: And by these Tables the Amplitude is thus found, *viz.*

Look the Latitude in the Head of the Tables, the Declination in the first Column on the Left-hand; and in the common Angle of Meeting is the Amplitude required.

*Example 1.* In the Latitude of 30 deg, the Sun's Declination being 7d. 0m. North, I demand the Amplitude?

*Ans.* The Amplitude is 8 deg. 6 min. For under Latitude 30d. in Page 140, and against Declination 7d. you will find 8d. 6m. which is the Amplitude from the East Northward at Sun-rising, and from the West Northward at Sun-setting. But if the Declination had been 7d. 0m. South, in Latitude 30d. as aforesaid, then the Amplitude would have been 8d. 6m. from the East Southward at Sun-rising, and 8d. 6m. from the West Southward at Sun-setting.

If there be any odd Minutes of Declination, take the Proportional Parts.

*Example 2.* In the Latitude of 42m. 30m. the Sun's Declination being 12d. 15m. I demand the Amplitude?

*Ans.* The Ampl. is 16d. 43m. found as follows: According to the former Directions, for the Lat. of 42d.

and Declin. being  $\left\{ \begin{array}{l} 12 \\ 13 \end{array} \right\}$  d. the Ampl. is  $\left\{ \begin{array}{l} 16d. 15m. \\ 17d. 37m. \end{array} \right.$

Subtract, and their Difference is  $\text{-----}$  1d. 22m.

Then



Then say, as 1d. or 60m. is to 1d. 22m. or 82 m. so is 15m. to 20m. found as hereunder :

If 60m. give ——— 82m. what shall 15 min?

15

410

82

6|0)123|0(20m. Proportional Parts.

030 Remainder.

Lat. 42d. and Declin. 12d. the Amplit is 16d. : 15m.

To it add the Proportional Parts above ——— 00d. : 20m.

Gives Amplitude for Declin. 12d. 15m. to be 16d. : 35m.

Again, for Lat. 43d. { 12 } deg. Ampl. { 16d. : 31m.  
and Declin. ——— { 13 } — is ——— { 17d. : 55m.

Subtracted, makes the Difference to be ——— 1d. : 24m.

Then say, As 60m. is to 1d. 24m. or 84m. so is 15m. to 21m. found as hereunder ;

If 60m. give ——— 84 min. what shall 15m?

15

420

84

6|0)126|0(21 min. Proportional Parts.

06

00 Remainder.

Lat. 43d. and Declin. 12d. Amplitude is ——— D. M.  
To it add the Proportional Parts above ——— 16 : 31

00 : 21

Gives for Declination 12d. 15m. the Amplitude 16 : 52

Now because the given Latitude 42d. 30m. is in the middle, between 42d. and 43d. therefore the Medium of the Amplitude before found, is the Amplitude required, and is thus :

K 2

Lat.



Lat.  $\left\{ \begin{array}{l} 42 \\ 43 \end{array} \right\}$  d. Decl. 12d. 15m. the Ampl. is  $\left\{ \begin{array}{l} 16d. : 35m. \\ 16d. : 52m. \end{array} \right.$

Added together, is - - - - - 33d. : 27m.

The half is the Amplitude required - - - - 16d. : 43m.

Thus may the Amplitude be found for any odd Minutes of Latitude or Declination, though the Table is calculated for whole Degrees only.

By this Table the Variation of the Compass is most readily found; for by the Azimuth or Amplitude Compass find the Sun or Star's Magnetic Amplitude, at their Rising or Setting; and their true Amplitude (according to the Latitude of the Place, and their Declination, by this Table; the Difference of these Amplitudes (when both are North or both South) but their Sum (if one North the other South) is the Variation of the Compass.

But by the *Rectifier* it is most easily done thus:

Bring the Magnetic Amplitude (on the upper or innermost Compass) right against the true Amplitude (on the lower or outermost Compass) then doth the North Point in the upper, stand against the Variation in the lower; and the upper Compass is explained in all its Parts by the lower Compass.

*Example 1.* Suppose the Magnetic Amplitude at Sun-rising (found by the Azimuth or Amplitude Compass) be East Southerly 15d. 30m. and the true Amplitude (according to the Latitude of the Place, and Declination of the Object observed) be East Southerly 26d. 45m. I demand the Variation of the Compass?

By the *Rectifier*.

Bring 15d. 30m. East Southerly on the upper Compass, against 26d. 45m. East Southerly, on the lower Compass: Then doth the North Point on the first stand right against 11d. 15m. North Easterly on the latter: so that the Compass doth vary 11d. 15m. or 1 Point East.



Ex. 2. { True } Ampl. { 07d. 00m. East Northerly.  
 { Magn. } { 15d. 30m. East Southerly.  
 I demand the Variation of the Compass?

*By the Rectifier.*

Bring 15d. 30m. East Southerly on the upper Compass, right against 7 deg. East Northerly, on the lower Compass, then the North Point on the first stands against 22 deg. 30 min. on the last, North Westerly, that is two Points West Variation. In like manner for any other; and thus the Variation is most readily found. This *RECTIFIER* is made of Wood.

\*\*\*\*\*

The APPENDIX contains the Description and Use of INSTRUMENTS most useful in *Navigation*.

\*\*\*\*\*

*The Description and Use of the Fore-staff, or Cross-staff.*

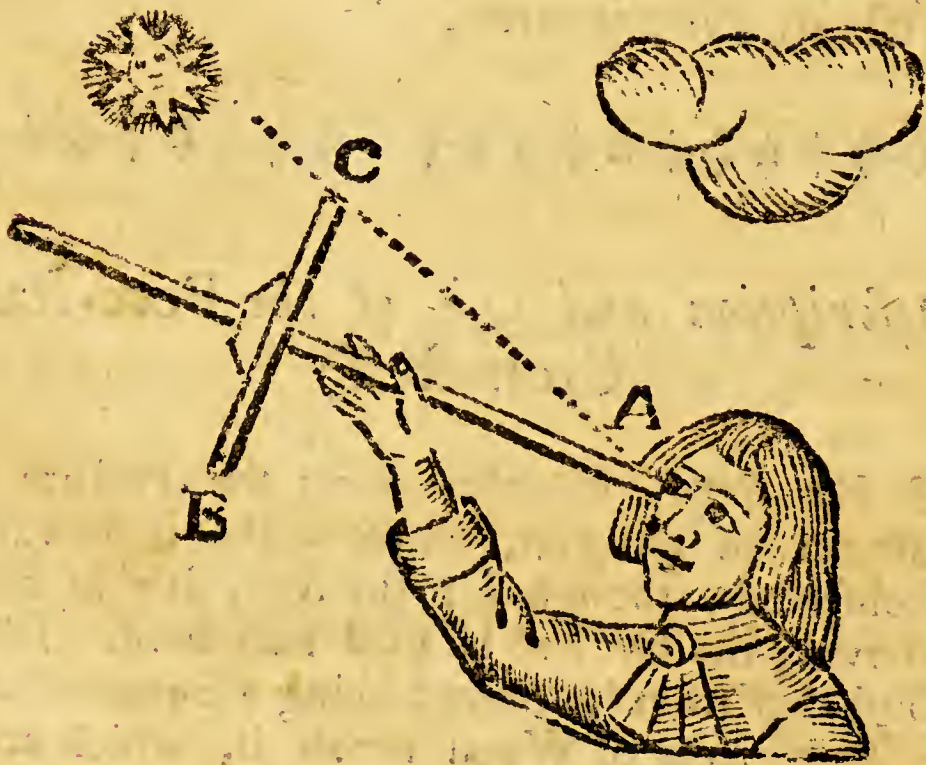
THE *Fore-staff*, so called from the Posture of the Observer in using it, whose Face is towards the Object observed; though for the Sun, it's so contrived (for preserving the Eye) to be used backward. It's called also a *Cross-staff* from its Form: being a Square Staff with three or four Pieces of Wood across it, which are called Crosses, or Vanes.



The Staff is usually about 30 Inches, or 3 Feet long, and more than half an Inch square, having four Sides, each graduated unequally, like a Scale of Tangents. To each of them belongs a distinct Cross; though sometimes the shorten Cross is made to serve two Sides of the Staff; that is, the Breadth is for the Ten-Cross, and the Length for the Thirty-Cross. Besides this, it hath two Crosses more, the longest is the Ninety-Cross, the other is the Sixty-Cross. These four Crosses are thus to be understood, viz.

$\left\{ \begin{array}{l} 10 \\ 30 \\ 60 \\ 90 \end{array} \right\}$  Cross belongs to that  $\left\{ \begin{array}{l} 4 \\ 10 \\ 20 \\ 30 \end{array} \right\}$  Side beginning at [and ending at  $\left\{ \begin{array}{l} 10 \\ 30 \\ 60 \\ 90 \end{array} \right\}$

The Figure of the *Fore-staff*.





*The Use of the Fore-staff.*

**I**T's common and ordinary at Sea, to take the Meridian Altitude of the Sun or Star with this Instrument, and by it to find the Latitude the Ship is in.

To perform which, observe these Precepts following.

1. *Note*, The 10, 30, 60, and 90 Crosss, are to be used according as the Meridian Altitude is more or less; that is, if less than 10d. use the 10 Crosss; if between 10 and 30d. use the 30 Crosss; if between 30 and 60d. the 60 Crosss; if more than 60, use the 90 Crosss.

2. Having considered which Crosss (according to the judg'd Altitude of the Object intended to be observed) is fuitable, put it on the Staff, so that the flat Side of the Crosss may be towards the flat or square end of the Staff; Then,

3. Hold the flat End of the Staff (as at A) to the Corner of your Eye; there let it rest upon your Eye-bone, as near the Corner of your Eye as you can, so it doth not hinder your Sight.

4. Then look to the upper End of the Crosss (as at C) for the Sun or Star, and at the lower End (at B) for the Horizon.

5. But if at the lower End of the Crosss, you see all Sky and no Water, then draw the Crosss a little nearer to your Eye.

6. If, on the contrary, you see all Water and no Sky, then slide the Crosss a little farther from you.

7. Then, if you see the Center of the Sun or Star at the upper End of the Crosss, and the Horizon at the lower End, the Crosss stands as it ought.

8. Wait till the Sun or Star be on the Meridian, making Observations often; and as the Sun or Star riseth, draw the Crosss a little nearer to your Eye.

9. If the Sun or Star be fallen, you will not see the Horizon, for the Water will hide it from you, and then Observing is over at that Time. Stir not the Crosss out of its Place, only see at what deg. &c. it resteth on that Side



of the Staff belonging to it ; and the Degrees and Minutes cut by the Edge of the Cross, is the Meridian Altitude or Complement thereof according to the Word *Alt.* or *Comp.* on the Staff.

*How to Use the Fore-staff backward.*

**T**HIS is only used with the Sun, and for this Purpose the Ten-Cross hath another Piece of Wood or Ivory put cross it; so that the lower Edge of this Cross Piece lieth even with the middle of the Square Hole in the Ten-Cross, which also answers to the middle of the Thickness of the Staff.

There is also a Plate of Brass with a Hole in it, and so fitted, that it will slide on and fit the Ends of the 90, 60, or 30 Cross: These two Things added to the Fore-staff makes it fit for a backward Observation of the Sun, which is thus, *viz.*

1. According as the Meridian Altitude of the Sun, is more or less, so use the 90, 60, or 30 Cross; putting it on the Staff, the flat Side of it exactly even with the flat End of the Staff, there screw it fast; and at one End of the Cross slip on the foresaid Brass Plate so as to leave a slit Sight thro' it, near the lower End of the Cross.

2. Put the Ten-Cross (having a Cross-piece on it as aforesaid) on the Staff, the flat Side of it towards the other Cross at the Staff's End.

3. Turn your Back to the Sun, look through the Slit in the Brass, at the lower End of the Cross, for the Shadow at the upper End of it, lying on the Ten-Cross in the Line answering the middle of the Staff, and on each Side of the Staff.

4. At the same Time the Horizon should be seen (thro' the foresaid Slit) to lie even with the shadow on the middle Line, in the Ten-Cross; and at each End of it, on both Sides the Cross.

5. In looking through the Slit in the Brass, you must bring the Shadow upon the middle Line, and if instead of the Horizon you only see the Water there, then draw the  
Ten.



Ten-Cross nearer, till the Shadow and Horizon agree or meet in the said middle Line.

6. On the contrary, looking as before, if instead of the Horizon you see Sky meet the Shadow on the middle Line; then put the Ten-Cross from you, (till you see the Horizon and the Shadow meet together) on the middle Line.

7. Continue observing till the Sun be at the highest; and as the Sun riseth, you must draw the Ten-Cross nearer in order to keep the Horizon and Shadow together on the said middle of it.

8. If the Sun be fallen (after you have continued observing as before directed) the Horizon will lie below the Shadow on the middle Line; then is the observing finished at that Time: Stir not the Ten-Cross out of its Place, for where it now stands (on that Side of the Staff belonging to the Cross at the End of it) is the Sun's Meridian Altitude, or Complement thereof, as before in observing forward.

Thus I have shewed how to take an Observation by the Cross-staff both forward and backward. The next Thing in Order, will be to shew how to work it; and for that Purpose take Notice of these following Rules.

*To work an Observation.*

1. **I**F the Sun or Star hath North Declination, and be on the Meridian to the Southward of you, subtract the Declination from the Meridian Altitude; the Remainder is the Height of the Equinoctial or Complement of the Latitude North.

2. But if the Object observed hath South Declination, and be to the Southward of your Zenith, add; the Sum (if it exceed not 90 deg.) is the Height of the Equator, or Complement of the Latitude North: If the Sum exceeds 90 deg. subtract 90 from it; the Remainder is the Latitude South.

3. If the Object hath North Declination, and be on the Meridian to the Northward, add the Declination  
to



to the Meridian Altitude; the Sum (if it exceed not 90d. is the Height of the Equator, or Complement of the Latitude, South: But if it doth not exceed 90 deg. subtract 90d. from the said Sum, the Remainder is the Latitude, North.

4. If the Sun hath South Declination, and be to the Northward at Noon, subtract the Declination from his Meridian Altitude; the Remainder is the Complement of the Latitude, South.

5. When the Sun hath no Declination, the Meridian Altitude is the Complement of the Latitude North, if he be South at Noon; and the contrary.

6. If the Sun be in the Zenith, and at the same time he hath no Declination, you are then under the Equinoctial.

7. But if the Sun hath North or South Declination, and in the Zenith, the Declination is the Latitude you are in, North or South.

8. If you observe the Sun or any Star upon the Meridian beneath the Pole, add the Meridian Altitude to the Complement of the Sun or Star's Declination; the Sum is the Height of the Pole, or Latitude of the Place.

These eight Rules are explained by the Examples following.

*Examples for working an Observation in North Latitude.*

*Example 1.* ADMIT at Sea, I observe the Sun's Meridian Altitude to be 42d. 20m. South, and at the same time the Sun's Declination is 10d. 10m. North, I demand the Latitude I am in?

	D.	M.	
The Meridian Altitude - - - - -	42	20	South
The Sun's Declination - - - - subtract	10	10	North
<hr/>			
The Complement of the Latitude - - -	32	10	
Subtract it from - - - - -	90	00	
<hr/>			
The Latitude I am in, is - - - - -	57	50	North

*Example*



*Example 2.* Being at Sea the 22d of *May*, Anno 1763, I find the Sun's Meridian Altitude to be 65 deg. 10 min. South ; I demand the Latitude ?

	D.	M.
The Meridian Altitude - - - - -	65	: 10 South
The Sun's Declination - - - - subtract	20	: 24 North
<hr/>		
The Complement of the Latitude - - -	44	: 46
Subtract it from - - - - -	90	: 00
<hr/>		
The Latitude I am in, is - - - - -	45	: 14 North

*Example 3.* Being at Sea the 27th of *November*, Anno 1765. I find the Sun's Meridian Altitude to be 26 deg. 30 min. South ; I demand the Latitude I am in ?

	D.	M.
The Meridian Altitude - - - - -	26	: 30 South
The Sun's Declination - - - - - add	21	: 16 South
<hr/>		
The Complement of the Latitude - - -	47	: 46
Subtract it from - - - - -	90	: 00
<hr/>		
The Latitude I am in, is - - - - -	42	: 14 North

*Example 4.* At Sea, the 25th of *April*, Anno 1766, I find the Sun's Meridian Altitude, by Observation, to be 58d. 45m. South ; I demand the Latitude I am in ?

	D.	M.
Meridian Altitude - - - - -	58	: 45 South
The Declination - - - - -	13	: 17 North
<hr/>		
The Complement of the Latitude - - -	45	: 28
Subtract it from - - - - -	90	: 00
<hr/>		
The Latitude I am in, is - - - - -	44	: 32 North

*Example 5.* Admit the 12th Day of *June*, 1763, I find the Sun's Meridian Altitude, by Observation, to be 80 deg. 35 min. North ; I demand the Latitude I am in ?

The



	D.	M.
Meridian Altitude - - - - -	80	: 35 North
Sun's Declination - - - - -	add 23	: 11 North
The Sum is - - - - -	103	: 46
From it subtract - - - - -	90	: 00
The Latitude I am in, is - - - - -	13	: 46 North

*Example 6.* Admit *August 22, 1771*, the Sun's Meridian Altitude was observed to be 85d. 15m North; I demand the Latitude of that Place?

	D.	M.
The Meridian Altitude - - - - -	85	: 15 North
Sun's Declination - - - - -	add 11	: 51 North
The Sum is - - - - -	97	: 06
From it subtract - - - - -	90	: 00
The Latitude of the Place is - - - - -	07	: 06 North

*Example 7.* Admit in a Ship at Sea, *June 19, 1772*, the Sun's Meridian Altitude is 66d. 46m. North; I demand the Latitude the Ship is in?

	D.	M.
The Meridional Altitude - - - - -	66	: 46 North
The Sun's Declination - - - - -	add 23	: 29 North
Complement of the Latitude - - - - -	90	: 15
From it subtract - - - - -	90	: 00
The Ship is almost under the Equinoctial	00	: 15 North

*Example to find the Latitude, by observing the Stars.*

*Examp. 8.* ADMIT I observe the *Bull's Eye* upon the Meridian, and find his Meridian Altitude to be 50d. 30m. South; I demand the Latitude I am in?  
The



	D.	M.	
The Declination of the <i>Bull's Eye</i> is	- -	16 : 00	North
The Meridian Altitude of the Star	- -	50 : 30	South
The Star's Declination	- - - - subtract	16 : 00	North
Complement of Latitude is	- - - - -	34 : 30	
Subtract it from	- - - - -	90 : 00	
The Latitude I am in, is	- - - - -	55 : 30	North

*Example 9.* Admit, I observe the bright Star in the *Great Dog's Mouth*, and I find his Meridian Altitude to be 35d. 45m. South; I demand the Latitude I am in?

	D.	M.	
The Declin. of the <i>Great Dog's Mouth</i> is	16 : 24	South	
The Meridian Altitude of the Star	- - -	35 : 45	South
The Star's Declination	- - - - - add	16 : 24	South
The Height of the Equator is	- - - - -	52 : 09	
Subtract it from	- - - - -	90 : 00	
The Latitude I am in, is	- - - - -	37 : 51	North

*Example for working an Observation in South Latitude.*

*Examp. 10.* ADMIT the 10th Day of *May, Anno 1770*, I find the Sun's Meridian Altitude, by Observation to be 62d. 00m. North; I demand the Latitude the Ship is in;

	D.	M.	
The Meridian Altitude	- - - - -	62 : 00	North
The Sun's Declination	- - - - - add	17 : 41	North
The Complement of the Latitude is	- -	79 : 41	
Subtract it from	- - - - -	90 : 00	
The Latitude the Ship is in, is	- - - - -	10 : 19	South

*Example 11.* Admit the 15th Day of *January, Anno 1764*, in Longitude 150d. East, I find the Meridian Altitude by Observation to be 38d. 45m. North? I demand the Latitude the Ship is in?

The



The Sun's Declination in the Meridian of *London* for the 15th of *January* is 21d. 11m. the daily difference at this Time is 11m. decreasing; therefore (in the Table of Proportion) in Page 20, you will find the Proportional Minutes to be 5m. which add to the Declination in the Meridian of *London*, the Sum is 21d. 16m. South, the Sun's true Declination for the Longitude of 150d. East.

	D.	M.	
The Meridian Altitude - - - - -	38	45	North
The Sun's Declination - - - - - subtract	21	16	South

Complement of the Latitude, is - - - - -	17	29
Subtract it from - - - - -	90	00

The Latitude the Ship is in, is - - - - -	72	31	South
---	----	----	-------

*Example 12.* Admit the 12th Day of *July*, Anno 1767, I find the Sun's Meridian Altitude to be 66 deg. 52 min. North, I demand the Latitude?

	D.	M.	
The Meridian Altitude - - - - -	66	52	North
The Sun's Declination - - - - - add	22	02	North

Complement of the Latitude, is - - - - -	88	54
Subtract it from - - - - -	90	00

Latitude required, is - - - - -	01	06	South
---------------------------------	----	----	-------

*Example 13.* A Ship at Sea, the Sun's Declination being 15d. 30m. South, and the Sun's Meridian Altitude 80d. 45m. South, I demand the Latitude the Ship is in?

*Answ.* The Latitude is 6d. 15m. South.

*Example 14.* The Sun's Declination being 11d. 14m. South, and his Meridian Altitude 79d. 38m. South; I demand the Latitude?

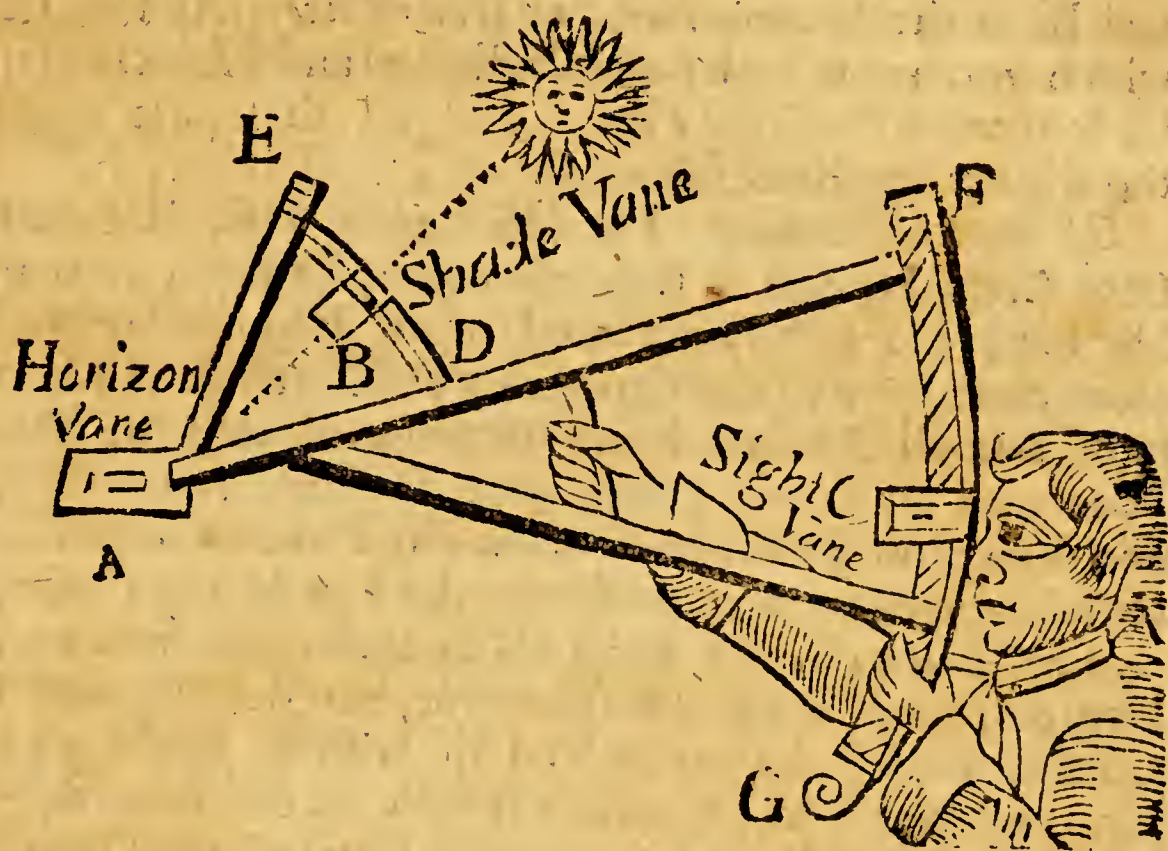
*Answ.* The Latitude is 0d. 52m. South.

*Note 1.* If you observe by the lower Part, Edge, or Limb of the Sun, you must add to the Altitude taken, 16m. for the Sun's Semidiameter, and the Sum will be the true Altitude of the Sun's Center.

*Note 2.* If you observe by the upper Limb of the Sun, subtract 16m. the Remainder is the Altitude of the Sun's Center.



*The Figure of the* QUADRANT.



*The Description and Use of the* QUADRANT.

**T**HIS Instrument (called a Quadrant, first invented by our Countryman Capt. *Davis*, and thence called *Davis's Quadrant*) is of a very commodious Form; at present the most general approved Instrument at Sea (at this time *Hadley's* particularly excepted) for observing the Sun's Meridian Altitude.

The Form of it (as in the Figure prefixed) may be of any Radius or Length, between 18 Inches and 3 Feet; but the most general now made, are Quadrants of 24 Inches Radius, with one Arch 65 Degrees, the other 25 Degrees, with a Glass Vane and a Shadow Vane.

The Principal Parts are three Vanes and two Arches; on which Arches the Degrees taken together make 90. from whence it hath the Denomination of a Quadrant.

*The*



The *Horizon Vane* (mark'd in the foregoing Figure A, and with it's Name) respects the Horizon in Time of observing: That which gives the Shadow or lucid Spot marked B, in the *Shadow Vane*, or *Glass Vane*: And that thro' which you are to look for both *Shadow* and *Horizon* marked C, is termed the *Sight Vane*: And all these are noted in the Figure by their Names.

*Of the two Arches.* The lesser noted DE, is called the 60th Arch, because it formerly contained no more than 60 Degrees, and is so numbered in the Figure, but now it often contains 65, and sometimes 70 Degrees: This Arch is of a small Radius, being so designed that the *Shadow Vane* used on it, being at so small Distance from the *Horizon Vane*, on which its Shadow (in Time of observing) is to fall, might be more visible to the Eye of the Observer.

This *Little Arch* is divided sometimes but into every 5 Degrees, and never less than every single Degree: It is numbered from the upper End E, with 0, 5, 10, 15, 20, &c. downwards to D, where it ends in the Line ADF (a Line in the middle of the longer Leg of the Quadrant) at 60, 65, or 70 Degrees, according as the other Arch is divided; so that the Numbers at D and F together, must always make 90 Degrees.

The *Greater Arch*, GF, is called the 30th Arch: It's of a large Radius, that it might contain the lesser Divisions of a Degree; and being of a competent Breadth, thereon are usually described 9 Concentric Circles, intersected with three Diagonal Lines, (sometimes six) in each Degree, making each Intersection two Minutes of a Degree, and sometimes one.

The *Great Arch* is divided on the Limb into Degrees by long Strokes; each again subdivided into six equal Parts by shorter Strokes; each small Division being 10 Minutes, and are numbered from the lower End G, with 5, 10, 15, &c. upwards to F, where it Ends in the Line ADF, either at 20, 25, or 30 Degrees: The Figures always at F and D together makes 90 Degrees as aforesaid.

The



*The Use of the QUADRANT.*

**T**HIS Instrument is rarely used otherwise than to observe the Sun's Meridian Altitude ; which to perform, I thus describe.

1. Put the Horizon Vane A on the End, and close to the Center ; the Sight Vane put on the Arch GF, close to the Back of it ; and the Shadow Vane or Glass Vane put on the little Arch DE, close to the Back of it, and fix the upper Edge of the Shadow Vane, to a Number of Degrees (on the Side of the 60 Arch) less than the Complement of the Altitude by 15 or 20 Degrees.

2. The Vanes being thus fixed upon the Quadrant, turning your Back to the Sun, the End G in your Hand, and F uppermost, look through the Sight Vane, causing the upper Edge of the Shade of the Shadow Vane, or lucid Spot from the Glass Vane, to lie upon the upper Edge of the Slit in the Horizon Vane, where is drawn a black Line ; at the same Time, if the Horizon appear through the said Slit in the Horizon Vane, the Vanes on the Quadrant stand at the Sun's present Altitude.

3. But if the Sky appear instead of the Horizon, slide the Sight Vane a little higher towards F ; on the contrary, if the Sea appear instead of the Horizon, then slide the Sight Vane lower towards G ; continue so to do till the Horizon appear through the Horizon Vane.

4. In order to obtain the Meridian Altitude (which is the greatest Altitude the Sun will have that Day, and the Thing used to find the Latitude) continue observing ; and as the Sun rises, the Sea will appear thro' the Horizon Vane ; and the Sight Vane must be slid lower accordingly ; Thus continue observing as often as may be convenient, till the Sun is at the highest.

5. When the Sun begins to fall, the Sky will appear through the Horizon Vane, instead of the Horizon ; then desist observing for that Day.

6. Having thus done, add the Degrees the upper Edge of the Shade Vane standeth at, to the Degrees and Min. cut by the Inside of the Sight Vane, their Sum is the Complement



plement of the Sun's Meridian Altitude, or the Distance on the upper Edge of the Sun from the Zenith; to which Sum add 16m. the Sun's Semidiameter, and the last Sum is the Distance of the Sun's Center from the Zenith, being the true Complement of the Sun's Meridian Altitude.

*Note;* The upper Edge of the Shade of the Shadow Vane respects the upper Limb of the Sun, and the lower Edge of the said Vane answers to the lower Limb of the Sun; so that observing by the first, you are to add 16 Minutes; on the contrary, observing by the latter, subtract 16 Minutes, to, or from what's on the Quadrant, the Sum or Difference is the Distance of the Sun's Center from the Zenith, called his Zenith Distance, or Complement of his Meridian Altitude.

Thus I have shewed how to take an Observation with the Quadrant: I come now to shew how to work it. The Difference in working an Observation taken by the Fore-staff and Quadrant, is only this: By the Fore-staff you take the Altitude by the Quadrant the Complement of the Altitude, or the Distance of the Sun from the Zenith.

*Altitude* is the Distance of the Sun from the Horizon; therefore if you subtract the Complement of the Altitude from 90d. the Remainder is the Altitude; which you may use as in the Use of the Fore-staff, in Pages 153 and 154.

But it's usual to work Observations (made by the Quadrant) by the Complement of the Sun's Meridian Altitude; I will therefore give some general Rules, and some particular Examples for their Explanation.

The General Rules are,

1. **I**F the Sun hath North Declination, and upon the Meridian to the Southward of the Observer, add the Sun's Declination to the Zenith Distance, (or Complement of the Sun's Meridian Altitude) the Sum is the Latitude you are in, North.

2. If the Sun be to the Southward of you, and hath South Declination, subtract the Sun's Declination from the



the Zenith Distance, the Remainder will be the Latitude you are in, North: But if the Declination exceed the Zenith Distance, subtract the less from the greater, and the Remainder is the Latitude, South.

3. If the Sun be to the Northward of you, and hath South Declination, add the Sun's Declination to his Zenith Distance, the Sum will be the Latitude, South.

4. If the Sun be to the Northward of you, and hath North Declination, subtract the Sun's Declination from his Zenith Distance, the Remainder will be the Latitude, South; but if the Declination exceed the Zenith Distance, subtract the less from the greater, and it gives the Latitude, North.

I might have given more general Rules; but if you understand those eight Rules for the Use of the Fore-staff, you cannot err in these, in using the Quadrant: And for their Explanation, see the Examples following.

*Working an Observatin in North Latitude.*

*Example 1.* **O**N the 10th of *April*, 1763, the Sun comes to the Meridian in the South, and by Observation, found his Zenith Distance, or Complement of his Meridian Altitude, to be 34d. 47m. that is, his upper Limb was so much from the Zenith: I demand the Latitude of the Place of Observation?

	D.	M.	
Compl. of the Sun's Meridian Altitude	— 34	: 47	South
The Sun's Semidiameter	— — — — —	add 00	: 16
Distance of the Sun's Center from Zenith	— — — — —	35	: 03 South
Declination	— — — — —	add 07	: 57 North
Latitude of the Place required, is	— — — — —	43	: 00 North

*Example 2.* The 14th Day of *August*, Anno 1763, I find the Complement of the Sun's Meridian Altitude, by Observation, to be 28d. 48m. South; I demand the Latitude the Ship is in?



	D.	M.
Comp. of the Sun's Meridian Altitude —	28	: 48 South
Sun's Semidiameter - - - - - add	00	: 16
Distance of the Sun's Center from Zenith	29	: 04 South
The Sun's Declination - - - - - add	14	: 26 North
The Latitude the Ship is in, is - - - -	43	: 30 North

*Example 3.* October 3, 1763, I find the Complement of the Sun's Meridian Altitude, by Observation, to be 47d. 35m. South; I demand the Latitude I am in?

	D.	M.
Comp. of the Sun's Meridian Altitude - -	47	: 35 South
Sun's Semidiameter - - - - - add	00	: 16
Distance of the Sun's Center from Zenith	47	: 51 South
The Sun's Declination - - - - subtract	03	: 57 South
The Latitude the Ship is in, is - - - -	43	54 North

*Examp<sup>t</sup> 4.* The fifth Day of November, Anno 1763. I find the Complement of the Sun's Meridian Altitude, by Observation, to be 52d. 00m. South; I demand the Latitude the Ship is in?

	D.	M.
Comp. of the Sun's Meridian Altitude -	52	: 00 South
Sun's Semidiameter - - - - - add	00	: 16
Distance of the Sun's Center from Zenith	52	: 16 South
The Declination of the Sun - - subtract	15	: 43 South
Latitude the Ship is in, is - - - - -	36	: 33 North

*Example 5.* The 27th of May, 1767, the Sun to the Northward of me, and the Complement of his Meridian Altitude by Observation is 10d. 15m. I demand the Latitude the Ship is in?

	D.	M.
Sun's Declination - - - - -	21	: 19 North
Complement of Sun's Meridian Altitude	10	: 15 North
The Sun's Semidiameter - - - - - add	00	: 16
The Sun's true Zenith Distance, subtract	10	: 31 North
Latitude the Ship is in, is - - - - -	10	: 48 North

*Example*



*Example 6.* Admit the 29th Day of *June*, Anno 1763, the Sun upon the Meridian, I find, by Observation, the upper Limb of the Sun is 6d. 42m. to the Northward of my Zenith; I demand the Latitude I am in?

	D.	M.	
Sun's Declination - - - - -	23	17	North
Sun's upper Marg. Distance from Zen. -	06	42	North
Sun's Semidiameter - - - - - add	00	16	
Dist. of the Sun's Center from Zenith sub.	06	58	North
Latitude the Ship is in, is - - - - -	16	19	North

*Example 7.* The 21st of *July*, Anno 1763, in Longitude 165 deg. West, and the Sun being upon the Meridian, I find by Observation, the upper Margin of the Sun is 16d. 45m. to the Northward of my Zenith; I demand the Latitude the Ship is in?

	D.	M.	
The Sun's Declination at <i>London</i> , - - -	20	32	North
Proportional Min. for Longitude subtract	00	05	
Sun's Declination in the Meridian given	20	27	North
Sun's Supreme Marg. Dist. from Zenith -	16	45	North
Sun's Semidiameter - - - - - add	00	16	
Sun's Central Dist. from the Zenith sub.	17	01	North
Latitude the Ship is in, is - - - - -	03	26	North

*Working an Observation in South Latitude.*

*Example 8.* **T**HE 14th Day of *July*, Anno 1763, in Longitude 120 deg. East, the Sun being upon the Meridian, I find the Complement of his Meridian Altitude, by Observation, to be 48d. 28m. North: I demand the Latitude the Ship is in?

L 3

Com-



	D.	M.
Comp. of the Sun's Meridian Altitude —	48	: 28 North
Sun's Semidiameter ———— add	00	: 16
Sun's Central Distance from the Zenith —	48	: 44 North
Sun's Declination for the Longit. subtract	21	: 47 North
The Latitude the Ship is in, is ————	26	: 57 South

*Example 9.* The 25th of *October*, Anno 1766, in Longitude 120 deg. West, and the Complement of the Sun's Meridian Altitude, by Observation, is 27d. 29m. North; I demand the Latitude the Ship is in?

	D.	M.
Comp. of the Sun's Meridian Altitude —	27	: 29 North
Sun's Semidiameter ———— add	00	: 16
Sun's Central Distance from the Zenith —	27	: 45 North
The Declination of the Sun's Prop. — add	12	: 19 South
The Latitude the Ship is in, is ————	40	: 04 South

*Example 10.* Admit the 24th of *December*, Anno 1766. I find the Sun upon the South Part of the Meridian, and by Observation the Complement of the Sun's Meridian Altitude 15d. 10m. I demand the Latitude the Ship is in?

	D.	M.
Compl. of the Sun's Meridian Altitude —	15	: 10 South
Sun's Semidiameter ———— add	00	: 16
Sun's Central Dist. from the Zenith subtract	15	: 26 South
The Declination of the Sun ————	23	: 27 South
Latitude the Ship is in, is ————	08	: 01 South

Thus much I thought necessary to add by way of Explanation upon the foregoing Rules, in Page 162, which exhibit and explain a more perfect and accurate Method, both in taking and working an Observation, than hath been usually made use of.

*Note,*



*Note 1.* The Sun's Semidiameter here added to the Complement of its Meridian Altitude, may be placed on the Quadrant, so that its Addition by the Pen may be omitted; For this Purpose the Quadrants have on the back Edge of the little Arch (every 5 Degrees numbered, differing from those on the flat Side) the Semidiameter of the Sun: So that placing the upper Edge of the Shadow Vane, to the Degree on the said back Edge of the Arch, the Quadrant then sheweth the true Complement of the Altitude, or the Distance of the Sun's Center from the Zenith; which prevents adding 16 Minutes after observing.

*Note 2.* There is another Contrivance now made use of, which is, by fixing a Convex Glass in such Manner in the Shade Vane, that the Diameter of the Glass may exactly range with the upper Edge of the said Vane, and which Glass will then, in Time of Observation, cast an illuminated Spot on a round black Spot made in the Horizon Vane: This is useful when the Edge of the Shadow reflected from the Shade Vane is not very conspicuous, the Spot being discernable when the latter is not: The Manner is thus:

Set that Part of the Glass Vane, which is right against the Middle or Center of the Glass, to the Degrees on the Side of the little Arch, and then cause the enlightened Spot of the Glass to lie on the black Spot or Circle on the Horizon Vane; at the same Time look for the Horizon thro' it, as before directed, in Page 160; so you will have (observing by this Glass in the Vane) the true Complement of the Sun's Altitude, or the Distance of his Center from the Zenith.

### *The Description and Use of the NOCTURNAL.*

1. **T**HE *Nocturnal* consists of three Parts; the first termed the unmoveable Part, is the broadest and greatest; on which is a Handle to hold it by, in Time of Observation, or using it.



On the Fore-side of which, in the outermost Circle, are the twelve Months, and each Month subdivided into its respective Days; they are counted towards the Left-hand, from the Tip, or nearly so, when you hold it erect by the Handle, and marked with their Names, or the first Letters thereof; as *Jan.* for *January*, *Feb.* for *February*, *Mar.* for *March*, &c. Within the Circle of the Months is a Circle divided into 24 equal Parts or Hours, each Hour divided into Halves and Quarters; used to find the Time of Full Sea or High-water.

On the Back-side of this Part, are the 32 Points of the *Mariner's Compass*, South uppermost, and East on the Left-hand: To each Point is set the Delineation of the North Star, above or under the Pole; which is known by *Und.* for *Under*, *Abo.* for *Above*.

Formerly there was made two Sorts of Nocturnals, one for the Great Bear, the other for the Little Bear: Those made for the Guards of the Great Bear, or *Charles's Wane*, commonly called the two Pointers, have *February* at the Top; but those made for the Guards of the Little Bear, have *April* at the Top: But they are now made for both Bears in one Nocturnal, and are known by having either two Circles or Months, marked GB and LB; or two short Teeth or Indices, proceeding from the second or middle Part of it, marked GB and LB; signifying Great Bear, or Little Bear.

2. The second moveable middle Part hath two Circles on it; the outermost is divided into the 29 Days and a half of the Moons Age; the innermost is divided into 24 equal Parts or Hours, each Hour subdivided into Halves and Quarters; this Part hath a Tooth, or short Index proceeding from it, with the Edge continued in a Right-line from the Center, which is to be set to the Day of the Month when used: Some have two Indices, marked G on one, and L on the other; G standing for Great Bear, and L for Little Bear; signifying the Nocturnal is made for both Bears; and may be used for either.



3. The third and moveable Part is called the Index ; it is uppermost on the Fore-side of the Instrument, having one Edge proceeding in a Right-line from the Center, (which in Time of Observation) must be turned to the Guards : Through all three Pieces, in the Center of the Instrument, is a Hole, through which you are to see the North Star, when the Index is turned to the Guards.

*The Use of the NOCTURNAL.*

BY it may be found the Hour of the Night, the Bearing of the Guards, and the Declination of the North Star from the Pole ; by which may be found the Latitude, as shall be shewed in Order.

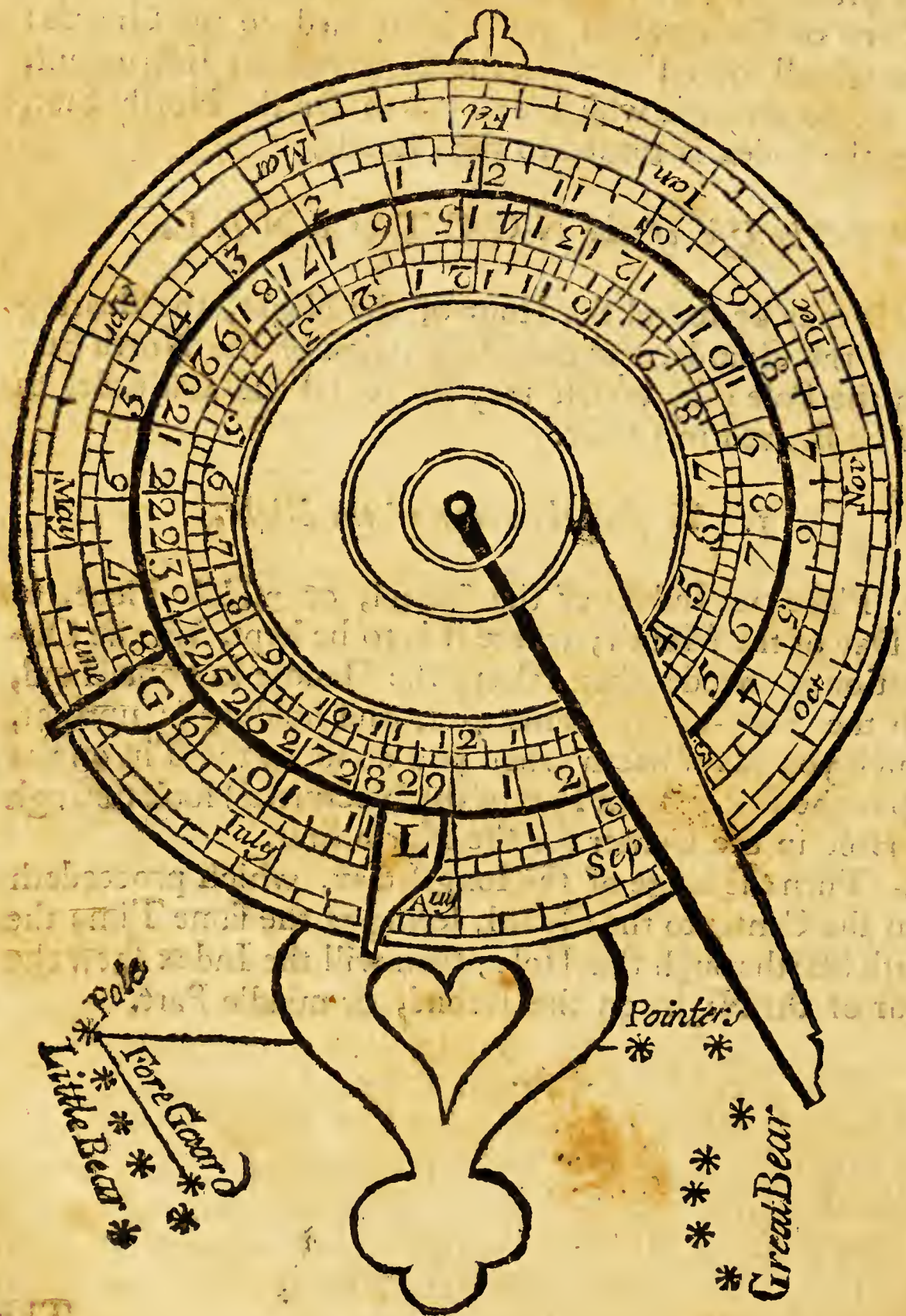
1. *To find the Hour of the Night.*

1. Place the Index of the second, or middle Piece, to the Day of the Month ; where it is to be kept, 'till the Observation is ended ; then taking the Handle in your Hand, with the Fore-side towards you, and holding it upright, (which you may discern when you do so, by the Tip on the Top of the first or great Part of the Nocturnal) look through the Hole in the Center for the North Star.

2. Turn the Edge of the long Index, which proceedeth from the Center to the Guard, seeing at the same Time the North Star through that Hole ; then will the Index shew the Hour of the Night on the second, or middle Part.



## The Figure of the NOCTURNAL.





2. To find the Bearing of the *Guards*, either of the Little or Great Bear; that is, upon what Point of the Compass they are, and thereby the North Star's Declination from the Pole.

1. Having observed all the particular Directions as before, in finding the Hour of the Night, you must see the North Star through the Hole, and the *Guards* by the Edge of the long Index.

2. Then look on the Back-side of the *Nocturnal*, what Point of the Compass standeth against the foresaid Edge of the Index, which is the bearing of the *Guards*; and at the said Point of the Compass is figured the North Star's Declination from the Pole at that Time, either above or under.

*Note*; As the *Nocturnals* are made to fit the *Old-Style*, the Index must be adjusted, in all Problems relating to Time, by fixing it eleven Days backward from that Observation.

*Example 1.* The 31st of *December*, or the 20th, O.S. at Six of the Clock in the Morning, observing the *Pointers* or *Guards* of the Great Bear by the Edge of the Index: I demand their Bearing, and Declination of the North Star.

Right against the Edge of that Index you observe with, and on the Back-side of the *Nocturnal*, is S.W. by S. the Point of the Compass required; and on the said Point of the Compass is 2d. 33m. *und.* signifying the North Star is then 2d. 33m. under the Pole, in the Circle marked G.B.

*Example 2.* The 7th of *March*, or 24th of *Feb.* O.S. I observe (according to the Directions before given) at Seven of the Clock in the Evening, the *Fore Guard* of the Little Bear by the Edge of the long Index: I demand its Bearing, and Declination of the North Star?

Seeing the North Star thro' the Hole in the Middle, and the *Guard* of the *Little Bear* by the Edge of the long Index, (note always that Edge respecting the Center of the Instrument) and the Index cutting Seven of the Clock; then on the Back-side of the *Nocturnal*, and against the said Edge of the Index, is N.E. the Point of its Bearing; and on the said Point is figured 0d. 35m. *Abo.* which signifieth the North Star is then 35 Minutes above the Pole, in the Circle marked L.B.



3. *To find the Moon's Southing by the Nocturnal.*

To do this, look for the Moon's Age in the outermost Circle, on the middle or second Piece on the Nocturnal; and right against it in the innermost Circle of the same Piece is the Southing.

Example. *If the Moon be 19 Days old, I demand her Southing?*

Right against 19, in the outermost Circle, is almost  $3\frac{1}{2}$  in the innermost Circle; which is half an Hour past Three of the Clock in the Morning nearly, the Time of the Moon's coming to the South.

4. *To find the Time of Full Sea by the Nocturnal.*

1. Set the short Index of the middle Part which stands at 12, to the Time of Full Sea, on the New or Full Moon (for the Place proposed) in the innermost Circle of the great Piece.

2. Keeping that there, bring the long Index to the Moon's (Southing, or) Age, on the middle Piece.

3. Then right against the long Index, and in the innermost Circle on the great Piece, is the Time of Full Sea required.

Example. *The Moon being 19 Days old, I demand the Time of Full Sea at Gravesend?*

1. Bring the Index of the middle Part (which stands at 12) to  $1\frac{1}{2}$  Hour (which is N.N.E. and S.S.W. the Point of the Compass making Full Sea at *Gravesend*, on the New and Full Moon) in the innermost Circle of 24 Hours on the great Piece, keeping that fast there.

2. Turn the long Index to 19 Days (the Moon's Age, or to  $3\frac{1}{2}$  Hours the Moon's Southing) on the middle Piece.

3. Then right against the long Index, and in the innermost Circle (on the great Piece) is 5 Hours, the Time of Full Sea, or High-Water in the Morning, at *Gravesend*.



5. *To find the Latitude by the Nocturnal and Fore-staff.*

1. Find the North Star's Declination from the Pole by observing with the Nocturnal, as directed in Example 1, or 2, of its Use, in Page 171.

2. Then at the same Time with a Fore-staff, take the Altitude of the North Star.

3. If the North Star be above the Pole, subtract its Declination from (if under, add to) its Altitude; The Sum or Difference is the Latitude required, North.

*Example.* Suppose the 7th of *March*, or 24th of *Feb.* O.S. at Seven of the Clock in the Evening, observing with the Nocturnal, you find the *Guard* of the Little Bear to bear N.E. which is *od.* 35m. above the Pole; and at the same Time, by the Fore-staff, find the Altitude of the North Star 42d. 10m. I demand the Latitude of the Place?

	D.	M.
From the Altitude of the North Star - -	42	10
Subtract its Declination above the Pole -	00	35
	<hr/>	
Remainder is the Latitude required - - -	41	35 North

*Example 2.* The 31st of *December*, or 20th, O.S. at Six o'Clock in the Morning, observing with the Nocturnal, I find the *Guards* or *Pointers* of the *Great Bear* S.W. by S. which is 2d. 33m. under the Pole; and at the same Time, by the Fore-staff, find the Altitude of the North Star 45d. 22m. I demand the Latitude of the Place of Observation?

	D.	M.
To the Altitude of the North Star - - -	45	22
Add its Declination from the Pole under	02	33
	<hr/>	
Sum is the Latitude required - - - - -	47	55 North

*The Description and Use of Gunter's Scale.*

**T**HIS Instrument for its quick and easy Dispatch of the most common and useful Proportions, deserves  
as



as generally to be known in its Uses, as by its Name: On that Account we shall first give a Description thereof, and then with as much Clearness and Brevity as possible, its manifold Uses.

1. *Gunter's Scale* (so called from Mr. *Gunter*, its first Contriver) is usually made of Box Wood, commonly two Feet long, and one Inch and a half broad; on which are placed the Lines or Scales of Numbers, Sines, Tangents, &c. There are two Sorts, the long or Flat Gunter, and the Sliding-Gunter: On both Sorts are the same Lines, though differently used; the first Sort with the Compasses, the latter by Sliding.

2. The Lines generally set on *Gunter's*, are eight, and have their Names at the Right-hand End thereof, under one another, thus; Sine Rumb, Tang. Rumb, Numbers, Sines, Versed Sines, Tangents, Meridian (or Meridional Parts) and equal Parts.

3. The Sine Rumb, and Tang. Rumb, are both Points of the *Mariner's Compass*; the first is figured from the Left-hand towards the Right, with 1, 2, 3, 4, 5, 6, 7, and 8, at which is a Brass Center-pin; the latter is figured thus, 1, 2, 3, and 4, at the said Center-pin; and thence back again towards the Left-hand with 5, 6, and 7; each Point in both Lines (where it can) is subdivided into Halves and Quarters: These two Lines are only useful in Navigation.

4. The next under Tang. Rumb, is the Line of Numbers figured thus; near the Left-hand End it begins at 1, and towards the Right-hand is 2, 3, 4, 5, 6, 7, 8, 9; then 1 is the Middle, at which is a Brass Center-pin; going still on 2, 3, 4, 5, 6, 7, 8, 9, and 10 at the End, where is another Center-pin: This Line is of general Use, and requires the larger Account; wherefore take these three following Notes for the Line of Numbers.

Note 1. *All the Figures on this Line may be taken singly as they stand; or be increased, or diminished at Pleasure, so it be in Decuple or Ten-fold Proportion. That is, the first 1 may be counted for 1, or 10, or 100, or 1000, &c. then*



then the next 2 is accordingly 2, or 20, or 200, or 2000, &c. Again, the first 1 may be reckoned for 1 Tenth, or 1 Hundredth, or for a Thousandth Part. &c. then the next 2 is 2 Tenths, or 2 Hundredths, or 2 Thousandth Parts, &c.

So that if the first 1 be esteemed 1, the middle 1 is then 10; and 2 to its Right-hand is then 20, 3 is 30, 4 is 40, and 10 at the End is 100. Again, if the first 1 be counted 10, the next 2 is 20, 3 is 30, and so on, making the middle 1 now 100; the next 2 is 200, 3 is 300, 4 is 400, and 10 at the End is now 1000.

In like Manner, if the first 1 be esteemed for 1 Tenth Part, the next 2 is Tenths, and the Middle 1 is 1; and the next 2 is 2, and 10 at the End is now 10. Again, if the first 1 be counted for one Hundredth Part, the next 2 is 2 Hundredth Parts; the Middle 1 is now 10 Hundredth Parts, or 1 Tenth Part; and the next 2 is 2 Tenth Parts; and 10 at the End, is now but 1 whole Number or Integer.

*Note 2.* As the Figures are increased, or diminished in their Value, so in like Manner must all the intermediat Strokes or Subdivisions be increased or decreased: That is, if the first 1 (at the Left-hand) be counted 1, then 2 (on the Right-hand of it) is 2; and each Subdivision between them now is one Tenth Part, and so all the Way to the Middle 1, which now is 10; the next 2 is 20. Now the longer Strokes between 1 and 2 are to be counted from 1, thus 11, 12, where is a Brass-pin) then 13, 14, 15, (something a longer Stroke than the rest) then 16, 17, 18, 19, and 20, at the Figure 2: And all the shorter Strokes between these longer are now each to be counted for a Tenth Part; from the Middle 1 to the next 2, now 20; from whence the longer Strokes between the Figures are Units, thus 21, 22, 23, &c. to 3, which now is 30; and the shorter Strokes between them, each now is a Tenth Part of an Integer: from 3, each short Stroke (or little Division) is five Tenth Parts of an Unit.

Again,



Again, If 1 at the Left-hand be Ten, the Figures between it and the Middle 1 are common Tens, and the Subdivisions (between each Figure) are Units, and from the Middle 1 to 10 at the End, each Figure is so many Hundreds; and between these Figures, each longer Division is Ten; and from the middle 1 to 2, each less Division is an Unit; from 2 to 3, each less Stroke is two Units; from the Figure 3 to the End, each shorter Stroke is five Units.

Some Scales are otherwise subdivided, which the Reader will attend unto, and thence very easily ascertain the value of each Subdivisions, if what is aforementioned be duly understood.

*Note 3.* On the *Line of Numbers* may be counted a Number of any Denomination; whether Measure, as Inches, Feet, Yards, Miles, Leagues, &c. or Weight, as Hundreds, Pounds, Ounces, &c. or Money, as Pounds, Shillings, Pence, &c. or Time, as Years, Months, Days, Hours, &c. provided always the Integer be divided, or supposed to be divided decimally, or into Tens.

5. Next under Numbers is the *Line of Sines*, beginning at the Left-hand, and figured thus, 1, 2, 3, &c. to 10; then 20, 30, 40, &c. to 90, ending at the Right-hand, where is a Brass Center-pin: These Figures never change their Value or Denomination, being here (and in all other Lines under it) called Degrees.

From the Beginning of this Line to 10 Degrees, each Degree is commonly divided into 12 Parts, by longer and shorter Strokes, making each 5 Minutes; from 10 Degrees to 20, each smaller Stroke has 10 Minutes; from 20 to 30 Degrees, each is fifteen Minutes; from thence to 60 Degrees, some are twenty, but the most are thirty Minutes; and from 60 to 80 Degrees, each Division is a Degree; 80 and 90 are so near together, that they admit but of one Stroke between, which is for 85 Degrees.

6. Next to the *Line of Sines*, is the *Line of Versed-Sines*, beginning at the Right-hand against 90, (in the Sines) and from thence figured towards the Left-hand; thus,



thus, 10, 20, 30, 40, &c. ending at ( the Left-hand End) about 169 Degrees ; the Subdivisions are thus, from 10 to 30, each is 2 Degrees ; from thence to 90, it's angle Degrees ; from thence to 120, it's half Degrees ; and from thence to the End, it's divided each into 15 Minutes.

7. Under *Versed Sines* is the *Line of Tangents*, beginning at the Left-hand, as the *Sines* do ; from thence figured to the Right-hand, thus, 1, 2, 3, &c. to 10 ; and so on, 20, 30, 40, and 45 at the Right-hand, where is a little Brass Center-pin, just under and even with 90 in the *Sines* ; from thence back again it is figured 50, 60, 70, 80, &c. to 89 : ending at the Left-hand End, where it began at 1 Degree : The Subdivisions of this Line are the same as those of the *Sines*.

8. Next to the *Line of Tangents*, and under it, is the *Line of Meridional Parts*, beginning at the Right-hand, and is numbered thus, 10, 20, 30, &c. to the Left-hand, where it ends at 87 Degrees. This Line, with the *Line of equal Parts* under it, are used together, only in *Mercator's Sailing* ; the uppermost Line contains the Degrees of the Meridian or Latitude in a *Mercator's Chart*, and the lower is the Equator, and contains the Degrees of Longitude.

9. These eight Lines thus subscribed, are set on the *Sliding Gunter*, but not in the same Order, being some on one Side, and some on the other : Also the *Line of Numbers*, *Sines*, and *Tangents*, are set double, that is, one on each Side, as the middle Piece slides ; which middle Piece is so contrived, as to slip to and fro easily ; to slide out, and to be put in, any Side uppermost, in order to range these Lines together ; or against one another, most proper for solving the Questions wrought by the *Sliding Gunter* : Of which this short Description may suffice.



1. *The Use of Gunter's Scale, both single and sliding, in Arithmetic.*

**I**N order to a right Understanding of the Use of this Scale, it's necessary to Number well on it; that is, to find readily a Place representing any given Number, Point, or Degree, &c. but chiefly on the Line of Numbers; which is as follows.

**P R O B L E M I.** *To find a whole Number on the Line of Numbers.*

**Rule 1.** **L**O O K the first Figure of the given Number among the figured Divisions.

2. For the second Figure, count so many Tenths (or longer Strokes) from the figured Division, towards the Right-hand, as are Units in the said second Figure.

3. Then for the third Figure, count from the last Tenth (representing the second Figure) so many lesser Strokes (or Centesims) as that Figure hath Units.

4. In like manner, for the fourth Figure, count from the last Centesim so many Thousands (or lesser Strokes) as are Units in it: and so on, for more Figures, though four Figures, or Thousands, are as many as can well be discerned on a two Foot Gunter.

5. This done, the last Place is the Point where the propounded Number is represented.

*Example 1.* To find the Point in the Line of Numbers that doth represent 12?

According to the Rule above, I take the Division at the Figure 1 (in the middle of the Line of Numbers) for the first Figure of 12, the propounded Number; then for 2, the second Figure, I count 2 Tenths (or longer Strokes to the Right-hand) from the said Stroke at 12; and this last is the Point representing 12, where most commonly is a small Brass Center-pin, being oft in Use.

*Example*



*Example 2.* Suppose the Point representing 22, on the Line of Numbers, was required to be found?

The first Figure in the Number 22 being 2, I take the Division in the Figure 2 for it; and for the second Figure 2, I count 2 Tenths onwards; and that is the Point representing 22.

*Example 3.* I desire to know the Point on the Line of Numbers, that represents 144.

The first Figure being one, I take the Division at the Middle 1 for it; the second Figure being 4, I count 4 Tenths onwards, and that is 140; from thence count 4 Centesms farther: for the third and last Figure; This last Place is the Point representing 144.

*Example 4.* Let it be required to find, on the Line of Numbers, the Point representing 1728?

For the first Figure 1, take the middle 1; for the second Figure 7, count as before, onward; 7 Tenths, and that is 1700: Then for 2, the third Figure count 2 Centesms from the last, and it represents 1720: lastly, for the fourth Figure 8, estimate 8 thousand Parts from the last: This Point last found represents 1728.

**P R O B II.** *To find a Fraction, or broken Number, on the Line of Numbers.*

**T**H E Fractions to be found on this Line must always be Decimals; as these, 1, .01, .001; 2, .02, .002. &c. that is,  $\frac{1}{10}$ ,  $\frac{1}{100}$ ,  $\frac{1}{1000}$ ,  $\frac{2}{10}$ ,  $\frac{2}{100}$ ,  $\frac{2}{1000}$ , &c. either of Inches, Feet, Yards, Miles, or the like; also in Weight, or Time, or any other Denomination whatsoever.

So that all other Fractions must be reduced into Decimals, before they can be found on the Line of Numbers; and being so reduced, they are expressed and found upon this Line as whole Numbers by the Rule in *Problem I.* and need no Example.



PROB. III. *To perform Multiplication by the Line of Numbers.*

The RULE is,

AS 1 is to the Multiplier, so is the Multiplicand to the Product.

Now to work this, or any Proportion on the *Gunter*, this is a general Rule.

1. Extend the Compasses from the first Term to the second Term.
2. That Extent laid the same way from the third Term, will reach to the fourth Term, or Thing required.

By the *Sliding Gunter*, thus ;

1. Set the first Term counted on the sliding or middle Piece, right against the second Term counted on the fixed Piece.
2. Then seek the third Term, (always on the same Piece, the first Term was counted) and against it on the other Part is the fourth Term, or Thing required.

*Example 1.* What is the Product of 8 multiplied by 4 ?

The Analogy or Proportion is this : As 1 is to 4 ; so is 8 to the Product.

Or, it's thus : As 1 is to 8 ; so is 4 to the Product.

1. By the *Gunter* with Compasses, thus ;

Extend the Compasses from 1 to 4 : that Extent laid from 8 (the same way) reacheth to 32, the Product of 8 multiplied by 4.

Or the Extent from 1 to 8, being laid from 4, reacheth to 32, the Product as before.

2. By



2. By the *Sliding-Gunter*, thus ;

Set 1 at the beginning of the middle or sliding Piece, right against 4 on the fixed or outside Piece ; then against 4 on the first, is 32 on the second, the Product required.

Or (set as before) 1 against 8 ; then against 4 on the first, is 32 on the second, the Product, as before.

*Example 2.* What is the Product of 16, multiplied by 5 ?  
The Proportion to work it by, is this : As 1 is to 5 ; so is 16 to the Product.

1. By *Gunter* with Compasses, it's thus ;

The Extent from 1 to 5 being laid from 16, reacheth to 80, the Product required.

2. By the *Sliding Gunter*, thus ;

Set 1 on the middle Piece, against 5 on the out-side Piece ; then against 16 on the first, is 80 on the second, the Product as before.

PROB. IV. *To perform Division by the Line of Numbers.*

The Rule or Proportion is thus ;

AS the Divisor is to 1, so is the Dividend to the Quotient.

*Example 1.* If the Dividend be 64, and the Divisor 4 ; what is the Quotient ?

To do this, the Proportion is ; As 4 is to 1, so is 64 to the Quotient required.

1. By *Gunter* with Compasses, thus ;

The Extent from 4 to 1, laid (the same way) from 64 reacheth to 16, the Quotient required.



2. By the *Sliding Gunter*, thus ;

Set 4 on the outside Piece, against 1 on the middle Piece; then against 64 on the first, is 16 on the second ; which is the Quotient as above.

*Example 2.* How often is 144 contained in 1728 ?

To do this, the Proportion is thus : As 144, is to 1 ; so is 1728, to the Answer.

1. By *Gunter* with Compasses, thus ;

The Extent from 144 to 1, reacheth from 1728 to 12, the Quotient and Answer required.

2. By the *Sliding Gunter*, thus ;

Set 144 on the outside Piece, against 1 on the middle Piece : then against 1728 on the first, is 12 on the second, which is the Quotient as above.

PROB. V. To reduce a *Vulgar Fraction* to a *Decimal* by the *Line of Numbers*.

To perform this, the Proportion is thus ;

AS the Denominator of the given Fraction, is to its Numerator ; so is 1 to the Decimal Fraction required.

*Example.* Suppose it be required to reduce  $\frac{3}{4}$ , a *Vulgar Fraction* into a *Decimal Fraction* ?

*Note.* A *Decimal Fraction* hath for its Denominator an Unit, with as many Cyphers as its Numerator hath Places, and the Proportion to find the Numerator is thus ; As 4 is to 3, so is 1 to the Numerator of the *Decimal Fraction* required.

1. By *Gunter* with Compasses, thus ;

The Extent from 4 to 3 reacheth (the same Way) from 1, to .75, or  $\frac{75}{100}$ , the *Decimal Fraction* required.

2. By



2. By the *Sliding Gunter*, thus ;

Set 4 on the outside Piece, against 3 on the middle Piece ; then against 1 on the first is .75, or  $\frac{3}{4}$  on the second, the Decimal Fraction required to be found : So that .75, or  $\frac{3}{4}$ , is equal in Value to  $\frac{3}{4}$ .

P R O B. VI. *Of Continual Proportion, or Geometric Progression ; which is unto two given Numbers, to find a 3d, 4th, 5th, &c. Number in a continual, or continued Proportion, by the Line of Numbers.*

*The Analogy by which it is effected, is this ;*

AS the first Number given is to the second ; so is the second to the third ; and so is that third, to a fourth ; and so is that fourth to a fifth, &c.

*Example.* Let the two Numbers given be 2 and 4, unto which it's required to find a third, fourth, &c. Proportional.

For the Performance hereof, the Rule is thus ;

As 2 is to 4, so is 4 to a third ; and so is that third to a fourth, &c.

1. By *Gunter* with Compasses, thus ;

The Extent from 2 to 4 reaches from 4 to 8, the third ; and from 8 to 16, the fourth ; and from 16 to 32, the fifth Proportional Number ; and so on, to as many as you please : So that 2, 4, 8, 16, 32, &c. are Numbers in continued Geometric Proportion, as was required.

2. By the *Sliding Gunter*, thus ;

Set 2 on the middle Piece, to 4 on the outside Piece ; then against 4 on the first, is 8 on the second, for the third Proportional ; and against 8 on the first is 16 on the second, the fourth Proportional ; and in like Manner against 16 is 32, the fifth Proportional, as was required : And so on for more.



P R O B. VII. *Of the Rule of Three Direct, or three Numbers being given, to find a fourth in a direct Proportion, by the Line of Numbers.*

*The Analogy whereby this is performed, is thus ;*

**A**S the first Number is to the second ; so is the third to the fourth Number required.

*Example 1.* If the Diameter of a Circle be 7 Inches, and the Circumference thereof 22, what is the Circumference of a Circle, whose Diameter is 14 Inches ?

To perform this, the Analogy is thus ; as 7 is to 22 ? so is 14 to the Circumference required.

1. By *Gunter* with Compasses, thus ;

The Extent from 7 to 22, (laid the same Way) from 14, will reach to 44, the Circumference of the Circle, whose Diameter is 14 ; which was required.

2. By the *Sliding Gunter*, thus ;

Set 7 on the middle Piece, against 22 on the outside Piece ; then against 14 on the first, is 44 on the second, which is the Circumference, as above.

*Example 2.* If the Circumference of a Circle is  $3\frac{14}{100}$  or  $3\frac{14}{100}$ , and its Diameter 1 ; what will the Diameter of another Circle be, whose Circumference is 44 ?

The Proportion is ; As  $3\frac{14}{100}$  is to 1 ; so is 44 to the Diameter required.

1. By *Gunter* with Compasses, thus ;

The Extent from  $3\frac{14}{100}$  to 1, reacheth from 44 to 14, the Diameter required.

2. By the *Sliding Gunter*, thus ;

Set  $3\frac{14}{100}$  on the outside Piece, right against 1 on the middle Piece : then against 44 on the first, is 14 on the second, which is the Diameter required, as before.

*Note,*



*Note,* In the *Rule of Three Direct*, if the third Number be greater than the first, then will the fourth Number be greater than the second: But if the third Number be less than the first, then the fourth will be less than the second.

*Example 3.* If 30 Acres of Land be worth 25 Pounds a Year; how much a Year will 54 Acres be worth.

To do this, or any Question in the *Rule of Three*, always in the Proportion let the first and third Numbers or Terms be of one Kind or Denomination; and then thus it is: As 30 Acres is to 25 Pounds; so is 54 Acres to 45 Pounds.

1. By the *Gunter* with Compasses, thus:

The Extent from 30 to 25, reacheth from 54 to 45 the yearly Rent required.

2. By the *Sliding Gunter*, it's thus:

Set 30 against 25, then against 54 on the first, is 45 on the second, as before.

By this Time, the Reader is, we presume, so well acquainted in the Way of Working a Proportion on the Line of Numbers, with Compasses or without, that it's a needless Thing to express it in Words, being always the same: We shall therefore for the future set down the Proportion, leaving the manner of its Operation to Practice, except in Cases where the Working differs from what went before.

P R O B. VIII. *Of the Rule of Proportion Inverse, or Three Numbers given, to find a fourth in an Inverse Proportion, or in the backward Rule of Three, by the Line of Numbers.*

I N this Rule you must note, if the third Number be greater than the first, then will the fourth be less than the second. But,

2. If



2. If the third be less than the first, the fourth is to be greater than the second.

3. And to resolve Questions in the backward Rule of Three, the Proportion is thus;

As the third Number is to the second; so is the first to the fourth.

*Example.* If 72 Pioneers make a Trench in 48 Hours, in how long Time will 54 Pioneers make it?

By the Directions above, this is the Proportion: As 54 Men is to 48 Hours; so is 72 Men to 64 Hours, the Answer to the Question: From whence you may conclude that 54 Men will perform as much in 64 Hours, as 72 Men in 48 Hours.

**P R O B. IX.** *Of Duplicate Proportion, or three Numbers given, to find a fourth in a Duplicate Proportion by the Line of Numbers.*

**T**HIS Rule is chiefly used in Proportion of Lines to Superficies, &c. wherein the first and second Terms are to be of one Kind or Denomination.

*Example 1.* If the Diameter of a Circle be 1, and its Area or Content 0.78539; what's the Content of a Circle whose Diameter is 14?

To perform this, the first and second Terms (by the Note above) are to be Lines; that is, the Diameters given, and then the Proportion is thus: As 1 is to 14; so is 0.785 to a fourth; And so is that fourth to the Content required.

1. By *Gunter* with Compasses, it's thus;

The Extent from 1 to 14 reacheth from 0.785 to 11; and the same Extent laid the same Way from 11, reacheth to 154, the Content required.

2. By



2. By the *Sliding Gunter*, it's thus ;

Bring 1 on the middle Piece, right against 14 on the outside Piece ; then against 0.785 on the first, is 11 on the second ; and against 11 on the first, is 154 on the second, the Content as before.

*Example 2.* If the Diameter of a Circle be 7, and its Area 38.5 ; what is the Area of a Circle, whose Diameter is 12 ? *Answer* 113. For,

As 7 is to 12, so is 38.5 to 66 ; and so is 66 to 113, the Area required.

*Example 3.* If the Diameter of a Circle be 1, and its Area 0.78539 : what is the Diameter of a Circle whose Area is 154 ? *Answer*, 14 is its Diameter.

In this, the Proportion is of Superficies to Lines, which is thus ; As Area 0.785, is to Area 154 ; so is the Square of the Diameter 1, to the Square of the Diameter required.

1. By *Gunter* with Compasses, it's thus ;

The Extent from 0.785, to 154, reacheth from 1 to 196, the Square of the Diameter required.

Then divide the Space between 1 (always the middle 1, if the Number of Places be odd ; but if even, the first 1) and 196 into two equal Parts ; the Foot of the Compasses in the middle resteth at 14, the Diameter of the Circle, whose Area is 154.

2. By the *Sliding Gunter*, it's thus ;

Set 0.785 against 154, and against 1 on the first, is 196, on the second ; then find the middle between 1 and 196, which is at 14, the Diameter as before.

*Example 4.* The Diameter of a Circle being 1, and its Area, 0.785 what is the Diameter of a Circle whose Area is 113 ? *Answer*, 12 is the Diameter required.

For as 0.785 is to 113, so is 1 to 144 ; the middle between it and 1, is at 12, the Diameter required.

P R O B.



**P R O B. X.** *Of Triplicate Proportion, or three Numbers given, to find a fourth in a Triplicate Proportion by the Line of Numbers.*

**T**HIS Problem concerneth the Proportion of Lines to Solids, and the contrary; in which, always make the first and second Term to be of one Denomination.

*Example 1.* If an Iron Bullet weigh 9 Pounds, and its Diameter is 4 Inches, what is the Weight of another Iron Bullet whose Diameter is 6 Inches.

To perform this, the first and second Terms are to be Lines, that is, the given Diameters; and then the Proportion is thus:

As 4 is to 6; so is 9 to 13.5; and so is 13.5 to 20.2; and so is 20.2 to 30.3; that is 30 Pounds and 3 Tenths of a Pound, which is the Weight required.

That is, 1. By *Gunter* with Compasses, thus;

The Extent from 4 to 6 being laid three Times from 9, will reach to 30 Pounds 3 Tenths, the Weight required.

And, 2. By the *Sliding Gunter*, it's thus;

Set 4 against 6, and against 9 on the first is 13.5 on the second; then against 13.5 on the first, is 20.2 on the second; and against 20.2 on the first, is 30.3 on the second; that is 30 Pounds 3 Tenths, as before.

*Example 2.* If an Iron Bullet 1 Inch Diameter, weigh Pounds 0.1406 Parts; what is the Weight of another, whose Diameter is 4 Inches, it being of the same Metal?  
*Answer,* 9 Pounds. For,

As 1 is to 4; so is 0.1406, to 0.562; and so is 0.562 to 2.25; and so is 2.25, to 9 Pounds, the Weight required.

*Example*



*Example 3.* If a Gun 6 Inches Bore require 11 Pound of Powder, how much will serve a Gun 4 Inches Bore?

*Answer,* Pounds 3.25 Parts.

For, As 6 is to 4; so is 11 to 7.3; and so is 7.3, to 4.88; and so is 4.88 to 3.25; which is Pounds 3.25 Parts of a Pound, or Pounds  $3\frac{1}{4}$  of Powder.

*Example 4.* If an Iron Bullet 1 Inch Diameter, weigh Pounds 0.1406 Parts; what Diameter shall that be, which weigheth 9 Pounds of the same Metal? *Answer,* 4 Inches.

For it's thus; As 0.1406, is to 9; so is 1 to 64, the Cube of the Diameter required; then divide the Space between 1 and 64 into 3 equal Parts, and the Foot of the Compasses in the first  $\frac{1}{3}$  Part from 1 reaching to 4, the Diameter of the Iron Shot weighing 9 Pounds.

II. *The Use of the Line of Numbers commonly called Gunter's Line, in measuring Superficies, as Board, Glass, Land, &c.*

P R O B. I. *The Length and Breadth of any Square, or Long-Square Superficies given, to find the Area or Content thereof.*

**T**HE Proportion is this; As 1 is to the Breadth, so is the Length to the Content.

*Example 1.* A plane Superficies, as a Board or Plank given to be measured, the Breadth thereof is 15 Inches, and its Length 61 Inches; what is the Content of it? *Answer,* 915 Inches.

For, As 1, is to 15; so is 61, to 915 Inches, the Content required.

*Note,* Such as the Breadth and Length are, such is the Content; so that if the Breadth and Length be Feet, the Content is Feet; if Perches, then Perches, &c.

*Example*



*Example 2.* A Piece of Wainscot in Form of a Long Square, whose Length is Feet 15.5 Parts, and Breadth Feet 2.25 Parts; what is the Content? *Answer,* Feet 34.87 Parts. For as 1, is to 2.25; so is 15.5, to 34.87; that is, Feet 34 and 87 Parts is the Content.

**P R O B. II.** *The Breadth and Length of a Superficies given in one Kind of Measure, to find the Content thereof in another Kind of Measure.*

**T**O do this, the Proportion is thus: As the Number contained in the Area of Unity in the required kind of Measure, is to the Breadth; so is the Length, to the Content desired.

*Example 3.* A Plank or Board 15 Inches broad, 61 Inches long, I demand the Content of it in Feet? *Answer,* Feet 6.35 Parts of a Foot. For you must note, in a Foot Superficial, or a Square Foot, is 144 Square Inches; and therefore the Proportion is thus: As 144, is to 15 Inches; so is 61 Inches, to Feet 6.35 Parts of a Foot, the Content.

*Example 4.* A Piece of Land in Form of a Long Square, whose Breadth being 30 Perches, Length 183 Perches: what is the Content in Acres? *Answer,* Acres 34.31 Parts.

*Note,* 160 Perches is an Acre, and the Proportion is thus:

As 160 Perches, is to 30 Perches; so is 183 Perches, to Acres 34.31 Parts of an Acre, the Content of the Piece of Land.

*Example 5.* A Piece of Painting, in Form of a Long Square, whose Breadth in Feet is 3.5, and Length 21 Feet how many Square Yards is the Content? *Answer,* Yards 8.16 Parts of a Yard.

*Note,* 9 Feet is a Square Yard, and the Proportion is thus:

As 9, is to 3.5 Feet; so is 21 Feet, to Yards 8.16 Parts of a Yard, the Content.

**P R O B.**



**P R O B. III.** *The Breadth of a Superficies given in one Kind of Measure, and the Length of another; to find the Content in the greater Measure.*

**T**O do this, the Proportion is thus; As so many of the lesser Kind of the given Measure, as is equal to the Length of one of the required Measure, is to the given lesser Measure; so is the given greater Measure, to the Content, in the Measure required.

*Example 6.* Admit a Board of 10 Inches broad, and 20 Feet long, I demand the Content in Feet? *Answer,* Feet 16.6 Tenths of a Foot.

For the Proportion is thus; As 12, is to 10 Inches; so is 20 Feet, to Feet 16.6 Tenths.

*Example 7.* If a Board or Plank be 15 Inches broad, and 27 Feet long, what is the Content of it in Feet? *Answer,* Feet 33.75 Parts of a Foot, or  $33\frac{3}{4}$  Feet. For, As 12, is to 15 Inches; so is 27 Feet, to 33.75 Parts.

*Example 8.* A Board  $7\frac{1}{2}$  Inches Broad, and  $29\frac{1}{4}$  Feet long, what's the Content in Feet? *Answer,* Feet 18.28. For it's, As 12 is to  $7\frac{1}{2}$ ; so is  $29\frac{1}{4}$  to Feet 18.28 Parts.

*Example 9.* A Piece of Land (in Form of a Long Square) whose Breadth is 30 Perches, and Length in Chains 15.25 Links (measured by a Chain of 4 Perches in 100 Links) I demand the Content thereof in Acres? *Answer,* Acres 11.44. For it's, As 40, is to 30 Perches; so is Chains 15.25, to Acres 11.44 Parts of an Acre.

**P R O B. IV.** *The Breadth of a Superficies given, to find how much in Length will make a Foot, a Yard, a Perch, or an Acre, &c.*

**T**O do this, take this General Rule: As the Breadth is to a Foot, a Yard, &c. so is a Foot, a Yard, &c. to that Length which will make a Foot, a Yard, &c.

*Example*



*Example 10.* If a Board be  $7\frac{1}{2}$  Inches Broad, how much in Length will make a Foot square? *Answer*, Inches 19.2 Tenths of an Inch.

For the Proportion is thus : As 7.5, is to 12 ; so is 12, to Inches 19.2 Tenths in Length, which will make a Foot.

*Example 11.* A Plank 30 Inches Broad, how much in Length will make a Foot? *Answer*, Inches 4.8 Tenths of an Inch.

For, as 30 Inches is to 12 ; so is 12 to Inches 4.8 Tenths in Length to make a Foot.

*Example 12.* A Pane of Glass being in Breadth Feet 2.5 Tenths, how much in Length will make a Foot? *Answer*, 4 Tenths of a Foot. For it's thus ;

As 2.5, is to 1 Foot ; so is 1 Foot to 0.4 Tenths of a Foot in Length to make a Foot.

*Example 13.* A Piece of Matting being 27 Inches broad, how much in Length will make a Yard square? *Answer*, 48 Inches, or 4 Feet. For it's thus :

As 27 Inches, is to 36 Inches ; so is 36 Inches, to 48 Inches : But if the Breadth be given in Feet, that is, if for 27 Inches, it be  $2\frac{1}{4}$  Feet or 2.25 Feet, then it's thus ;

As 2.25, is to 3 Feet ; so is 3 Feet to 4 Feet in Length, to make a Yard square.

PROB. V. *The Diameter of a Circle given, to find the Circumference.*

THE Analogy or Proportion is thus : As 1 is to 3.142, so is the Diameter to its Circumference.

*Example 14.* If the Diameter of a Circle be 15 Inches, what is the Circumference of it? *Answer*, Inches 47.13 Parts of an Inch.

For, as 1 is to 3.142 ; so is 15 Inches to Inches 47.13 Parts, the Circumference required.

P R O B.



PROB. VI. *The Circumference of a Circle being given, to find its Diameter.*

THE Proportion is this? As 3.142, is to 1; so is the Circumference, to its Diameter.

Example 15. The Circumference of a Circle being 44 Feet, what is the Diameter thereof? *Answer*, Feet 14, for it's,

As 3.142, is to 1; so is 44 Feet, to Feet 14 the Diameter.

PROB. VII. *The Diameter of a Circle being given, to find its Area, or superficial Content.*

The Proportion is thus:

AS 1, is to the Diameter; so is 0.7854, to a fourth Number; and so is that fourth Number, to the superficial Content required.

Example 16. The Diameter of a Circle being 15 Inches, what is the Content of it? *Answer*, Inches 176.7 Parts.

For it's as 1, is to 15; so is 0.8754, to 11.78; and so is 11.78, to 176.7, the superficial Content required.

PROB. VIII. *The Circumference of a Circle being given, to find the superficial Content of it?*

The Proportion is this:

AS 1, is to the Circumference; so is 0.07958, to a fourth Number; and so is that fourth Number to the superficial Content required.

Example 17. If the Circumference of a Circle be 44 Inches, what's the Content? *Answer*, Inches 154.06 Parts of an Inch. For it is,

As 1, is to 44; so is 0.07958, to 3.5; and so is 3.5, to Inches 154.06 the Content required.



III. *The Use of the Line of Numbers in Solid Measure, such as Timber, Stone, Gauging, &c.*

PROB. I. *The Side of a Square Solid being given in Inches, to find how much in Length will make a Foot Solid?*

THE Proportion is thus: As the given Side, is to 12; so is 12 to a fourth Number; and so is that fourth Number, to the Length required to make a Foot Solid.

*Example 1.* A square Piece of Timber, or Stone, whose Breadth and Depth are each 8 Inches; how much in Length will make a Foot Solid? *Answer*, 27 Inches, or 2 Foot 3 Inches; For it is, As 8 is to 12; so is 12 to 18; and so is 18, to 27 Inches in Length, to make a Foot.

*Example 2.* A square Piece of Timber or Stone, whose Side is 2 Feet, or 24 Inches; how much in Length will make a Foot? *Answer*, 3 Inches. For it's as 24, is to 12; so is 12, to 6; and so is 6, to 3 Inches in Length, to make a Foot Solid.

PROB. II. *The Side of a Square Solid given in Foot Measure, (that is, the Decimal Foot, or a Foot divided into 100 equal Parts) to find how much in Length will make a Foot Solid.*

THE Proportion is thus: As the given Side, is to 1; so is 1, to a fourth Number; and so is that fourth Number, to the Length required, to make a Foot Solid.

*Example 3.* A square Piece of Timber, whose Side is Feet 15.2 Parts; how much in Length will make a Foot Solid? *Answer*, 0.432 Parts of a Foot. For it's, As 1.52, is to 1; so is 1, to 0.658; and so is 0.658, to 0.432 Parts of a Foot.

PROB.



**PROB. III.** *The Breadth and Depth of a Solid, whose two Ends are equal long Squares, being given in Inches, or in Foot Measure; to find how much in Length will make a Foot Solid?*

**1. THE** Proportion for Inches is thus: As 12, is to the Breadth; so is the Depth, to a fourth Number: Then,

As that fourth Number, is to 12; so is 12, to the Length in Inches to make a Foot Solid.

**2.** The Proportion for Foot-Measure is thus: As 1, is to the Breadth; so is the Depth, to a fourth Number. Then say, As that fourth Number, is to 1; so is 1, to the Length in Foot-Measure, to make a Foot Solid.

*Example 4.* A Piece of Timber or Stone, whose Breadth is 11 Inches, and Depth 19 Inches; how much in Length will make a Foot? *Answer,* Inches 8.27 Parts. For it's as 12, is to 11; so is 19, to 17.4: And then say, as 17.4 is to 12; so is 12, to Inches 8.27 Parts in Length, to make a Foot Solid.

*Example 5.* A Piece of Timber, in Breadth Foot 0.75 Parts, and Depth Foot 1.25 Parts; how much in Length will make a Foot Solid? *Answer,* Foot 1.06 Parts. For, it's as 1, is to 0.75; so is 1.25, to 0.94: Then say, As 0.94, is to 1; so is 1, to Foot 1.06 Parts in Length, to make a Foot Solid.

**PROB. IV.** *The Side of a Square Solid, and its Length being given, to find the Content.*

**1. WHEN** the Side is given in Inches, and Length in Feet, the Proportion is thus: As 12, is to the given Side; so is the Length, to a fourth Number; and so is that fourth Number, to the Content in Feet.



2. When the Side and Length are both given in Foot Measure, the Proportion is thus. As 1, is to the given Side; so is the Length, to a fourth Number; and so is that fourth Number, to the Content required.

*Example 6.* A square Piece of Timber, whose Side is 9 Inches, and Length 35 Feet; how many Feet of Timber are in it? *Answer*, Feet 19.68 Parts. For it is,

As 12, is to 9; so is 35, to 26.25; and so is 26.25, to Feet 19.68 Parts, the Content required.

*Example 7.* A Piece of Timber 16 Inches square, and 28 Feet long, how much is the Content? *Answer*, 50 Feet.

For it's as 12, is to 16; so is 28, to 37.3, and so is 37.3, to 49.8 Feet, the Content of the Piece of Timber.

*Example 8.* A Stone, Feet 2.75 Parts square, and Feet 7.50 Parts long; how much is the Content? *Answer*, Feet 56.72 Parts.

For it's as 1, is to 2.75; so is 7.50 to 20.6; and so is 20.6, to Feet 56.72 Parts, the Content required.

P R O B. V. *The Length, Breadth and Depth of a Square Solid being given, to find the Solid Content.*

1. **I**F the Breadth and Depth be given in Inches, and the Length in Feet, the Proportion is thus; As 12, is to the Breadth; so is the Depth, to a fourth Number. Then say, As 12, is to that fourth Number; so is the Length in Feet, to the Content in Feet.

2. When the Length, Breadth, and Depth, are all given in Foot Measure, then the Proportion is thus: As 1 is to the Breadth; so is the Depth, to a fourth Number. And then again say, As 1 is to that fourth Number; so is the Length to the Content in Feet.

*Example 9.* If a square Piece of Timber be in Breadth 19 Inches, Depth 11 Inches, and 20 Feet long; how much is the Solid Content? *Answer* Feet 29.03 Parts.

For it's thus: As 12 is to 19; so is 11 to 17.4. Then say,



say, as 12 is to 17.4; so is 20, to Feet 29.03 Parts, the Content required.

*Example 10.* A Stone 20 Inches broad, 13 Inches deep, and Feet  $15\frac{1}{4}$  or  $15\frac{25}{80}$  Feet in Length: How much is the Content? *Answer,* Feet 27.5.

For it's, As 12, is to 20; so is 13, to 21.67. And then, As 12, is to 21.67; so is 15.25, to 27.5, that is,  $27\frac{1}{2}$  Feet is the Content.

*Example 11.* A squar'd Piece of Timber, Feet 1.25 broad, Feet 0.56 deep, and 36 Feet long; how much is the Content? *Answer,* Feet 25.20 Parts, or  $25\frac{1}{5}$  Feet. For it is, As 1, is to 1.25; so is 0.56, to 0.7: And then say, As 1, is to 0.7; so is 36 to Feet 25.2 Tenths, the Content required.

**P R O B. VI.** *The Diameter of a Cylinder being given, to find how much in Length will make a Foot Solid?*

**1.** IF the Diameter be given in Inches, the Proportion is thus: As the given Diameter is to 13.531; so is 12, to a fourth Number; and so is that fourth Number, to the Length required to make a Foot Solid.

**2.** When the Diameter is given in Foot Measure, the Proportion is thus: As the given Diameter is to 1.128; so is 1, to a fourth Number; and so is that fourth Number to the Length, which will make a Foot Solid.

*Example 12.* A round Piece of Timber, or Stone, being 15 Inches Diameter; how much in Length will make a Foot Solid? *Answer,* Inches 9.76 Parts of an Inch. For it's,

As 15, is to 13.531; so is 12, to 10.82; and so is 10.82, to Inches 9.76 Parts, or  $9\frac{76}{80}$  Inches: But supposing the Diameter of the same to be taken in Foot-Measure, then it is Foot 1.25 Parts; and how much will make a Foot Solid? *Answer,* Foot 0.81 Parts of a Foot.

For it's thus: As 1.25, is to 1.28; so is 1, to 0.902; and so is 0.902, to Foot 0.815 Parts, or  $\frac{815}{800}$  Foot, to make a Solid Foot.



P R O B. VII. *The Circumference of a Cylinder being given, to find how much in Length will make a Foot Solid ?*

1. **W**H E N the Circumference is given in Inches, the Proportion is ;

As the Circumference, is to 42.54 ; so is 12, to a fourth Number ; and so is that fourth Number, to the Length required, to make a Foot Solid.

2. But if the Circumference be given in Foot-Measure, then the Proportion is ;

As the Circumference, is to 3.545 ; so is 1, to a fourth Number ; and so is that fourth Number, to the Length, to make a Foot Solid.

*Example 13.* If a round Stone or Tree, be 44 Inches about ; how much in Length will make a Foot ? *Answer,* Inches 11.22 Parts. For it is,

As 44, is to 42.54 ; so is 12, to 11.6 ; and so is 11.6, to Inches 11.22 Parts of an Inch, or  $11 \frac{22}{100}$  Inches.

But suppose the same was measured by Foot-Measure, and the Circumference found to be Feet 3.67 Parts ; how much in Length will make a Foot ? *Answer,* Foot 0.933 Parts. For it's thus ;

As 3.67, is to 3.545 ; so is 1, to 0.966 ; and so is 0.966 to Foot 0.933 Parts, or  $\frac{933}{1000}$  Foot.

P R O B. VIII. *The Diameter and Length of a Cylinder given, to find its Solid Content.*

1. **W**H E N the Diameter is given in Inches, and Length in Feet, the Proportion is thus,

As 13.531, is to the Diameter ; so is the Length, to a fourth Number ; and so is that fourth Number, to the Solid Content in Feet.

2. If the Diameter in Length are both given in Foot-Measure, then the Proportion is thus ;

As



As 1.128, is to the Diameter; so is the Length, to a fourth Number; and so is that fourth Number, to the Content required.

*Example 14.* A round Piece of Timber 10 Inches thro' and 30 Feet long; how many Feet of Timber are in it? *Answer,* Feet 16.38 Parts. For it's, as 13.531, is to 10: so is 30, to 22.16; and so is 22.16, to Feet 16.38 Parts of a Foot, or  $16 \frac{38}{100}$  Feet.

But suppose the same Piece, measured by Foot-Measure, then it's Feet 0.83 Parts through, and the Work is thus:

As 1.128, is to 83 or 0.83; so is 30, to 22.16; and so is 22.16, to Feet 16.38 Parts, or  $16 \frac{38}{100}$  Feet as before.

**PROB. IX.** *The Circumference and Length of a Cylinder, given; to find the Solid Content?*

1. IF the Circumference be given in Inches, and the Length in Feet, the Proportion is thus: As 42.54, is to the Circumference; so is the Length to a fourth Number; and so is this fourth Number, to the Solid Content in Feet.

2. When the Circumference and Length are both given in Foot-Measure, the first Term being 3.545 (instead of 42.54) the former Words will serve.

*Example 15.* A round Stone, or Tree, being 30 Inches about, and 25 Feet long; how many Feet Solid are in it? *Answer,* Feet 12.43 Parts. For it's thus, As 42.54, is to 30; so is 25, to 17.63; and so is 17.63, to Feet 12.43 Parts, to  $12 \frac{43}{100}$  Feet.

Now the Compass about being taken in Foot-Measure is Feet 2.50 Parts; And the Proportion is, As 3.545, is to 2.50; so is 25, to 17.63; and so is 17.63, to Feet 12.43 Parts, to  $12 \frac{43}{100}$  Feet, as before.

*Note 1.* When Timber tapers, that is, bigger at one End than the other, it's usual to take the Breadth and Depth in the Middle of its Length, and by them to measure the Piece as if both Ends were of a Bigness.







As  $\left\{ \begin{array}{l} 18.95 \\ 17.15 \end{array} \right\}$  is to 25.6, so is 40, to  $\left\{ \begin{array}{l} 54 \\ 59.71 \end{array} \right\}$  and so is  
 $\left\{ \begin{array}{l} 54 \\ 59.71 \end{array} \right\}$  to  $\left\{ \begin{array}{l} 73 \\ 89.12 \end{array} \right\}$  Beer Wine } Gallons.

1. By *Gunter* with *Compasses*.

1. The Extent from 1 to 0.7, will reach the same Way from 8 to 5.6; which being added to 20, the Head Diameter) makes 25.6 for the Mean Diameter. Then,

2. The Extent from 18.95 (the Gauge Point for Beer) to 25.6, will reach from 40 to 54; and that Extent turned over again reaches to 73, the Content in Beer Gallons.

In like Manner the Extent from 17.15 (the Gauge Point for Wine) to 25.6, being laid twice from 40, will reach to 89.12, the Wine Gallons.

2. By the *Sliding Gunter*.

1. Set 1 against 0.7, and against 8 on the First, is 5.6 on the Second; which added to 20 (the Head Diameter) makes 25.6 for the Mean Diameter. Then,

2. Set 18.95 (the Gauge Point for Beer) on the First, against 25.6 on the Second; then against 40 on the First, is 54 on the Second; then against 54 on the First, is 73 on the Second, the Content in Beer Gallons.

Also, if you set the Gauge Point for Wine 17.15, against the Mean Diameter 25.6, then against the Length of the Cask 40 on the First, you will find 59.71 on the Second; and against 59.71 on the First, you'll find on the Second 89.12, the Content in Wine Gallons.

P R O B. XI. *The Length of a Ship's Keel, and Breadth at the Beam being given, to find her Tunnage?*

I T is the Practice of Shipwrights about *London*, to multiply the Length of the Keel, Breadth and Half-breadth at the Beam, into one another, and to divide the last Product by 94, whose Quotient they count for the Ship's Tunnage; from whence I frame this Proportion following, to be wrought by the Line of Numbers.

1. As



1. As 188, is to the Breadth; so is the Breadth, to a fourth Number: Then say,

2. As 1, is to that fourth Number; so is the Length, to the Tunnage required.

*Example 17.* Suppose a Ship 72 Feet by the Keel, and 24 Feet by the Beam: I demand her Tunnage? *Answer,* Tuns 220.6 Tenths nearest. See the Work following.

As 188, is to 24; so is 24, to 3.06: And then,

As 1, is to 3.06; so is 72, to Tuns 220.6 Tenths.

1. By the *Gunter* with *Compasses*.

1. The Extent from the given Number 188, to the Breadth of the Beam 24, will reach from (the said Breadth) 24, to 3.06. Then,

2. The Extent from 1 to 3.06 will reach from the Length of the Keel 72, to Tuns 220.6 Tenths, the Tunnage required.

Or more briefly thus: The Extent from 13.71, (which is the Square Root of the given Number 188) to the Breadth of the Beam 24; being turned over twice from the Length of the Keel 72, reacheth to Tuns 220.6 Tenths, as before.

2. By the *Sliding Gunter*, thus;

1. Set the given Number 188, against the Breadth of the Ship 24, and against the said Breadth 24 on the First, is 3.06 on the second. Then,

2. Set 1 against 3.06, and against the Length of the Keel 72 on the First, is Tuns 220.06 Tenths on the Second, as before.

PROB. XII. *To find the Tunnage of a Box, Bale or Case, having its Length, Breadth, and Depth given.*

The RULE is this;

1. AS 66, is to the Breadth; so is the Depth, to a fourth Number. Then,

2. As 1, is to that fourth Number; so is the Length, to its Tunnage required, *Example*



*Example 18.* A Case or Bale being 6 Feet broad, 4 Feet deep, and 10 Feet long, I demand its Tunnage? *Answer,* Tuns 3.63 Parts. For it's thus;

1. By *Gunter's Scale*, with Compasses.

1. The Extent from the given Number 66, to the Breadth 6, reacheth from the Depth 4 to 0.363. Then,

2. The Extent from 1 to the last found Number 0.363, being laid from the Length 10, reacheth to 3.63; that is, 3 Tun, and 63 Parts of 100, or  $3\frac{63}{100}$ , Tuns.

2. By the *Sliding Gunter*, thus;

1. Set the given Number 66, against the Breadth of the Bale or Case 6; then against the Depth of it 4 on the first, you will find 0.363 on the second, a fourth proportional Number. Then,

2. Set 1 against the said Proportional Number 0.363; then against the Length of the Bale or Case 10 on the first, you will find, on the second, 3.63, or  $3\frac{63}{100}$  the Tunnage of the Bale or Case proposed.

*Note;* That 66 Feet is the Content of a Case that will inclose two *English Butts*, but the Cantlings of them are better than a third Part; therefore allowing 26 Feet for the Cantlings, the remaining 40 Feet are counted 1 Tun. And then the Rule is,

1. By the *Gunter* with Compasses for the foresaid *Examp.*

1. The Extent from the given Number 40, to the Breadth of the Case or Bale 6, which reach from the Depth 4 to 0.6 a fourth Proportional Number. Then,

2. The Extent from 1, to the said fourth Number 0.6 will reach the same Way, from the Length 10, to 6 Tuns, the Content of the Case or Bale required.

2. By the *Sliding Gunter*, thus;

1. Set the given Number 40, against the Breadth of the Bale or Case 6, then against the Depth of it 4, on the First, you will find 0.6 on the Second, a fourth Proportional Number. Then,

2. Set 1 against the said Proportional Number 0.6, and against the Length of the Bale or Case 10 on the First, you



you will find on the Second 6, the Tunnage of the Bale or Case proposed.

P R O B. XIII. *The Diameter of a Globe being given, to find the Solid Content ?*

The R U L E.

AS 1, is to the Diameter; so is 0.5236, to a fourth Number; and so is that fourth Number to a fifth; as so is this fifth, to its Solid Content required.

*Example 19.* A Globe whose Diameter is 8 Inches; what's the Solid Content? *Answer,* Inches 268. For it's wrought thus:

As 1, is to 8; so is 2.5236; to 4.19; and so is 4.19 to 33.5; and so is 33.5, to 268 Inches, the Solid Content of the Globe.

IV. *The Use of the Line of Numbers in Gunnery.*

P R O B. I. *The Diameter and Weight of any Piece of Ordnance being known; to find the Weight of any other, being of the same Metal and Shape, its Diameter being known.*

Like Solids are in Proportion, as the Cubes of their homologous Sides. Therefore the Rule is thus:

AS the Diameter of the known Gun is to the Diameter of the Gun whose Weight is required; so is the Weight of the known Gun to a fourth Number; and so is that fourth to a fifth; and so is that fifth to the Weight required.

*Example 1.* Suppose a Brass Saker, whose Diameter is Inches 11.5 Tenths, weighs 1900 Pounds; what will a Brass Gun weigh, whose Diameter is Inches 8.75 Parts?

*Answer,* 837.5 Pounds. For it's thus:

1. By Gunter's Scale with Compasses.

The Extent from the Diameter 11.5, to the Diameter 8.75; being laid three Times from the Weight 1900, will reach to 837.5 Pounds, the Weight of the Gun required.

And,

2. By the Sliding Gunter.

Set the Diameter 11.5, against the Diameter 8.75; then against the Weight 1900 on the First, is 1445 on the



the Second; and against 1445 on the First, is 1100 on the Second; Also against 1100 on the First, is 837.5 Pounds, the Weight required, on the Second.

**P R O B. II.** *Having the Diameter and Weight of one Piece of Ordnance, and the Diameter of another Piece of another Metal; to find the Weight of the last, it being of the same Shape with the former.*

The **R U L E** is thus;

1. **F I N D** the Weight of the Piece as if it had been of the same Metal as the propounded Piece, by the last Problem, in Page 204. Then,

2. Consider the Proportional Weights of Metals, which are known by the following Table of specific Gravity, estimated from the latest, and most approved Experiments.

Cast Lead is to	{	Cast Brass	} as 11.26 is to	{	8.208
		Cast Iron			7.135
		Marble			2.7
		Flint Stone			2.621

Cast Iron is to	{	Cast Brass	} as 7.135 is to	{	8.208
		Marble			2.7
		Flint Stone			2.621

The specific Gravity of *English* Pebble is 2.696, which is heavier than Flint Stone, and very near the Weight of Marble; Pebble Stone is 2.601; *Portland* Stone 2.57, and Common Stone is 2.5.

3. Having the Weights of both Pieces in one Sort of Metal, you must then proportion their Weight according to their different Metals, by the proportional Numbers of those Metals, and than 'tis done.

*Example 2.* If a Brass Saker of Inches 11.5 Tenths Diameter, weigh 1900 Pounds; What will an Iron Gun (of the same Shape) weigh, whose Diameter is Inches 8.75 Parts? *Answer*, 728 Pounds. For it's wrought thus:

1. I find by Prob. I. in Page 204, that a Brass Piece of Inches 8.75 Parts Diameter, will weigh 837.5 Pounds; but because this Piece is Iron, and the Proportion of Brass to Iron (as abovesaid) is as 8.208 is to 7.135; therefore say,

2. As



2. As 8.208, is to 7.135; so is 837.5, to 728 Pounds, Weight of the Iron Gun required.

**P R O B. III.** *By knowing the Allowance of Powder for one Gun; to find how much of the same Powder is requisite for another Gun?*

The R U L E.

**A**S the Diameter of the Bore of the Gun, whose Allowance is known, is to the Diameter of the Gun whose Allowance is required; so is the Allowance given, to a fourth Number; and so is that 4th, to a 5th; and so is the 5th, to the Allowance required.

But note; Here it's understood that both Guns are alike fortified; that is, they shall have the same Proportion in Weight and Thickness of Metal.

*Example 3.* If a Saker of Inches 3.5 Tenths Bore require 4 Pounds of Powder; what will a Demi-Cannon of Inches 6.5 Tenths Bore require? *Answer,* Pounds 25.62 Parts. For it's thus:

As 3.5, is to 6.5; so is 4, to 7.44; and so is 7.44, to 13.80; and so is 13.80, to Pounds 25.62 Parts, the Weight of Powder for the Demi-Cannon, in Proportion to the given Saker. But suppose the Weight of the Saker 1600, and the Weight of the Demi-Cannon 6000; what Allowance of Powder must it then have?

1. By Problem I. Find the Weight of the Demi-Cannon in Proportion to the Saker's Weight, which is thus:

1. As 3.5, is to 6.5; so is 1600, to 2971; and so is 2971, to 5517; and so is 5517, to 10246 Pounds, the Weight of the Demi-Canon, requiring Pounds 25.62 Parts of Powder for its Loading. But seeing its Weight is supposed to be 6000; say,

2. As 10246, is to 6000; so is 25.62, to Pounds 15, the due Allowance of Powder for the Demi-Canon of Inches 6.5 Tenths Bore, weighing 6000 Pounds; at the Rate of a Saker Inches 3.5 Tenths Bore, weighing 1600 Pounds, and requiring 4 Pounds of Powder.

P R O B.



**PROB. IV.** *Having the Diameter and Weight of one Bullet, and the Diameter of another of the same Metal given; to find the Weight of the latter.*

**The R U L E.**

**T**HE Weight of Bullets (of the same Metal) are in Triplicate Proportion of their Diameters, and wrought by the Directions in Problem X. of the first Uses of the Gunter, in Pages 188. and 189.

*Example IV.* If an Iron Bullet 4 Inches Diameter, weigh 9 Pounds; what will an Iron Bullet of 6 Inches Diameter weigh? *Answer,* Pounds 30.375 Parts. For it's thus;

As 4, is to 6; so is 9, to 13.5; and so is 13.5, to 20.25; and so is 20.25, to Pounds 30.375 Parts.

**PROB. V.** *Two Bullets, equal in Diameter, but of different Metals; by the Diameter and Weight of one, to find the Weight of the other.*

**The R U L E.**

**1.** **A**S the Proportion of one Metal is to the other, so is the Weight of the given Bullet to the Weight of the Bullet required.

*Example 5.* Suppose an Iron Bullet 6 Inches Diameter, weigh Pounds 30.375 Parts; what will a Flint Stone Bullet of the same Diameter weigh? *Answer,* Pounds 11.158 Parts. For it's wrought thus:

By Problem II. of Gunnery, (in Page 205) the Proportion of Iron to Flint Stone, is as 7.135 is to 2.621; therefore say,

As 7.135, is to 2.621; so is 30.375, to Pounds 11.158 Parts of the Weight of the Stone Bullet.

**PROB.**



**PROB. VI.** *Having the Diameter and Weight of a Bullet of one Kind of Metal, and the Diameter of any Bullet of any other Metal given; to find the Weight of the latter.*

The R U L E.

1. **FIND** the Weight of it (by Problem IV.) as if it was the same Metal.
2. Then find its Weight according to the Proportion of the Metals by the last *Problem*, and it's done.

*Example 6.* If an Iron Bullet 4 Inches Diameter, weigh 9 Pounds; what is the Weight of a leaden Bullet 6 Inches Diameter? *Answer*, Pounds 47.93 Parts. For it's thus wrought;

1. As 4, is to 6; so is 9, to 13.5; and so is 13.5, to 20.25; and so is 20.25, to Pounds 30.375 Parts, if it had been Iron; but as it is Lead, say,
2. As 7.135, is to 11.26; so is 30.375, to Pounds 47.93 Parts, the Weight being Lead.

**V.** *The Use of Gunter's Scale in Navigation; and first in Plane Sailing.*

C A S E I.

*The Course and Distance sailed being given; to find the Difference of Latitude and Departure from the Meridian?*

To do this, the Proportions are these:

**A**S Radius is to the Distance; so is the Sine of the Course to the Departure from the Meridian.

2. As Radius is to the Distance; so is the Sine Complement of the Course to the Difference of Latitude.

*Note*; The Radius, according to the Nature of the Proportion, may be any of these

8. Points



8 Points  
4 Points  
90 Degrees  
45 Degrees

} on the Line of {  
Sine Rumbs.  
Tangent Rumbs.  
Sines.  
Tangents.

And for Conveniency, that each Proportion may stand in one Line.

Let S. }  
S. c. }  
T. }  
T. c. }  
Crs. }  
Dist. }  
Diff. Lat. }  
Dep. }

stand for {  
Sine  
Sine Complement  
Tangent  
Tangent Complement  
Course  
Distance sailed  
Difference of Latitude  
Departure from the Meridian

*Example.* If a Ship sails SW. by S. 104 Minutes from Latitude 1d. 45m. North; I demand what Latitude she is in, and her Departure from the Meridian?

As S. 8 P. is to 104 M. so is S { 3 } Points to { Dep. 58 M  
5 } Points to { Diff. Lat 86 M

1. By the Gunter with Compasses.

The Extent from 8 Points (on the Line of Sine Rumbs) to 104 Min. (on the Line of Numbers) will reach the same Way from 3 Points (on the Line of Sine Rumbs) to 58m. (on the Line of Numbers) which is the Departure from the Meridian; and the Compasses kept at the same Distance, will reach (the same Way) from 5 Points (on the Line of Sine Rumbs) to 86 Minutes (on the Line of Numbers) which is the Difference of Latitude.

*Note;* The Course is 3 Points, because SW. by S. is 3 Points from the Meridian or South; and 5 Points is the Complement of the Course, because SW. by S. is 5 Points from the Parallel or West: Understand the like in any other Course.

O

2. By



By the *sliding Gunter*.

Slide 104 min. on the middle Piece, against 8 Points, on the Line of Sine Rumbs, on the lower outside Piece : then against 3 Points on the first, is 58 Minutes on the second, the Departure from the Meridian; and against 5 Points, on the first, is 86 Minutes on the second, the Difference of Latitude.

	D. M.
Latitude sailed from - - - - -	01 : 45 North
Difference of Latitude 86 Minutes or -	01 : 26 South
<hr style="width: 10%; margin-left: auto; margin-right: 0;"/>	
Subtract, gives the Latitude required - -	00 : 19 North

### C A S E II.

*Course and Difference of Latitude given, to find the Distance sailed, and Departure from the Meridian.*

To do this, the Proportions are these ;

1. As the Sine Comp. of the Course, is to the Difference of Latitude ; so is Radius to the Distance Run.
2. As the Sine Complement of the Course, is to the Difference of Longitude ; so is the Sine of the Course, to the Departure from the Meridian.

*Example.* Suppose a Ship sails N.N.E. from the Latitude of 2d. 15m. South, and then by Observation, is in Latitude 1d. 22m. North, what is her Distance sailed, and Departure from the Meridian ?

	D. M.
Latitude sail'd from - - - - -	02 : 15 South
Latitude by Observation - - - - -	01 : 22 North
<hr style="width: 10%; margin-left: auto; margin-right: 0;"/>	

Added, gives the Difference of Latitude 03 : 37 which reduced into Minutes by multiplying by 60, is 217 Minutes  
Then ;

As S. 6 Pts. is to 217 M. so is S.  $\left\{ \begin{smallmatrix} 8 \\ 2 \end{smallmatrix} \right\}$  Pts. to  $\left\{ \begin{smallmatrix} 235 \text{ the Dist.} \\ 90 \text{ the Dep.} \end{smallmatrix} \right\}$

C A S E



C A S E III.

*Course and Departure from the Meridian given; to find the Distance Run, and the Difference of Latitude.*

This is performed by these Proportions.

1. As the Sine of the Course, is to the Departure from the Meridian; so is Radius, to the Distance sailed.

2. As the Sine of the Course, is to the Departure from the Meridian; so is the Sine Complement of the Course to the Difference of Latitude.

*Example.* If a Ship sails SE. by E. from 1d. 10m. North Latitude, till her Departure be 92 Minutes: What is her Distance sailed, and Latitude she is in?

As S. 5 Pts. is to 92 M. so is S.  $\left\{ \begin{smallmatrix} 8 \\ 3 \end{smallmatrix} \right\}$  Pts. to  $\left\{ \begin{smallmatrix} 110 \text{ Dist.} \\ 61 \text{ Diff. L.} \end{smallmatrix} \right\}$   
D. M.

Latitude sailed from - - - - - 01 : 10 North.  
Difference of Latitude 61 Minutes, or - 01 : 01 South.

Subtract, gives the Latitude the Ship is in 00 : 09 North.

C A S E IV.

*Distance Run, and Difference of Latitude given, to find the Course, and Departure from the Meridian?*

These Proportions are these;

1. As the Distance sailed, is to Radius; so is the Difference of Latitude, to the Sine Complement of the Course.

2. As the Radius, is to the Distance sailed; so is the Sine of the Course, to the Departure from the Meridian.

*Example.* Admit a Ship sails between the S. and W. 8 Leag. from the *Lizard*, in 49d. 57m. North Latitude; and then by Observation, is in 46d. 27m. North Latitude, What is her Course and Departure from the Meridian?

O 2

D. M.



	d.	m.
Latitude sailed from - - - - -	49	: 57 North
Latitude by Observation - - - - -	46	: 27 North

The Difference of Latitude - - - 03 : 30 or 70 Leag.

1. As 98 Leagues, is to Sine of 90 Degrees ; so is 70 Leagues, to Sine 45d. 30m. whose Complement 44d. 30m. is the Course from the South Westward ; that is, South West, nearest. Then,

2. As Sine 90 Degrees, is to 98 Leagues ; so is Sine 44d. 30m. to 68.4 Leagues, the Departure from the Meridian.

1. *By Gunter with Compasses.*

1. The Extent from 98 Leag. on the Line of Numbers, to 90 Degrees, on the Line of Sines ; will reach the same Way from 70 Leag. on the Line of Numbers, to 45 deg. 30 min. on the Line of Sines ; which being subtracted from 90 deg. leaves 44d. 30m. for the Course.

2. The Extent from 90 Degrees, on the Line of Sines, to 98 Leagues, on the Line of Numbers, will reach from 44d. 30m. on the Line of Sines, to 68.4 Leagues, on the Line of Numbers, which is the Departure from the Meridian

2. *By the Sliding Gunter.*

1. Bring 98 Leagues, on the Line of Numbers on the middle Piece, against 90 Degrees on the Line of Sines, on the out-side Piece ; then right against 70 Leag. on the First, is 45 deg. 30 min. on the Second, which is the Complement of the Course, and subtracted from 90 deg. is 44d. 30m. and is near 4 Points from the South towards the West, or South West.

2. And as it now stands, against 44d. 30m. in the Line of Sines, on the out-side Piece, is 68.4 Leagues in the Line of Numbers, on the middle Piece, which is the Departure from the Meridian.

C A S E V.

*Distance Run, and Departure from the Meridian given, to find the Course and Difference of Latitude.*

The



The Proportions are as follows ;

1. **A**s the Distance sailed, is to Radius ; so is the Departure from the Meridian, to the Sine of the Course.

2. As Radius is to the Distance sailed ; so is the Sine Complement of the Course, to the Difference of Latitude.

*Example.* A Ship sails 354 Minutes between the South and East from 1d. 19m. South Latitude, until her Departure from the Meridian be 150 Minutes ; what is her Course and what Latitude is she in ?

1. As 354 Minutes, is to Sine 90d. so is 150 Minutes, to Sine 25d. so that the Course is N. Eastward, or NNE. a quarter East.

2. As S. 90 Degrees, is to 354 Minutes ; so is Sine 65 Degrees, to 323 Minutes, the Difference of Latitude.

D. M.

Latitude failed from is - - - - - 01 : 19 South  
The Difference of Lat. 323 Minutes, or 05 : 23 North

Subtract, gives the Latitude the Ship is in 04 : 04 North  
So that the Ship hath crossed the Equator.

**CASE VI.** *Difference of Latitude, and Departure from the Meridian given ; to find the Course and Distance Run.*

To do this, these are the Proportions.

1. **A**s the Difference of Latitude, is to the Departure from the Meridian ; so is Radius, to the Tangent of the Course.

2. As the Sine of the Course, is to the Departure from the Meridian ; so is Radius, to the Distance sailed.

*Example.* Sailing between the North and West, from Port in 1d. 59m. South Latitude, and then arriving at another Port which is in 3d. 8m. North Lat. and is also 209 Minutes to the Westward of the first Port. I demand the Course and Distance from the first Port to the second.

O 3

D. M.



Latitude of the first Port - - - - - 1 : 59 South  
 Latitude of the second Port ----- 3 : 08 North

Added, gives the Difference of Latitude 5 : 07 or 307m.

1. As 307 min. is to 209 min. so is Tangent 45 deg. to Tangent 34 deg. 15 min. the Course North Westward, or NW. by N. nearest.

2. As S. 34 degrees 15 minutes, is to 209 minutes; so is S. 90 degrees, to 370 minutes, the Distance between the two Ports.

1. By the *Gunter* with Compasses.

1. The Extent from 307 min. to 209 min. on the Line of Numbers, will reach from 45 deg. on the Line of Tangents, (that now being the Radius) to 34 degrees 15 min. on the same Line of Tangents, which is the Course from Meridian.

*Note*, When the Difference of Latitude is greatest, the Course is less than 45 degrees from the Meridian.

But when the Departure from the Meridian is greatest, the Course is more than 45 degrees from the Meridian.

2. The second Canon or Proportion for the Distance Run, is wrought as in the second or third Case, in Page 210, 211.

2. By the *Sliding Gunter*.

1. In this Case, place the middle Piece in such a Manner, that a Tangent Line may slide against a Tangent Line, also Numbers against Numbers : Then bring 307 min. on the Line of Numbers on the middle Piece, against 209 min. on the Line of Numbers on the outside Piece ; then against 45 degrees, on the Line of Tangents, on the middle Piece, is 34 degrees 15 minutes on the Tangents, on the out-side Piece, which is the Course required.

2. For the Distance, the manner of working is the same as hath been shewn in Cases First, Second and Third.



To resolve a Traverse by Gunter's Scale.

*Example 1.* A Ship in 40 Degrees North Latitude, and in 5 degrees 14 minutes West Longitude, sails first S.E. by S. 68 minutes, then SW. by W. 55 minutes, and then W.N.W. 75 minutes: I demand the Course and Distance from the first Place of Departure, and what Latitude and Longitude she is in?

To do this, First find the Difference of Latitude, and Departure from the Meridian, for each several Course, as directed in Case I. of Plane-Sailing, in Pages 208 and 209.

2. Collect the several Differences of Latitude into two Sums, viz. the Northing into one, and the Southing into another; and in like manner, the several Departures either East or West: Taking the Difference of the Northing and Southing, for the Difference of Latitude; and the Difference of the Easting and Westing, for the Departure from the Meridian.

3. Having now the Difference of Latitude, and the Departure from the Meridian known; the Course and Distance may be found by the Sixth Case of Plane Sailing, in Pages 213 and 214.

4. The Difference of Longitude may be found by this Proportion:

As the Sine Complement of the middle Latitude, is to the Departure from the Meridian; so is Radius, to the Difference of Longitude. See the Work following.

	M.	Pts.	M.
1. Course, As S. 8 Pts. is to 68; so is S.	{	3, to 37 $\frac{8}{10}$	E.ing
		5, to 56 $\frac{1}{10}$	S.ing
2. Course, As S. 8 Pts. is to 55; so is S.	{	5, to 45 $\frac{7}{10}$	W.ing
		3, to 30 $\frac{6}{10}$	S.ing
3. Course, As S. 8 Pts. is to 75; so is S.	{	6, to 69 $\frac{3}{10}$	W.ing
		2, to 28 $\frac{1}{10}$	N.ing
			Course



Courses.	Dist.	Diff. Lat.		Departure.	
		North	South	East	West
1. S.E. by S.	68		56.5	37.8	
2. S.W. by W.	55		30.6		45.7
3. W.N.W.	75	28.7			69.3
		28.7	87.1	37.8	115.0
			28.7		37.8
		Diff. Lat.	58.4		77.2

Dep.

3. Then; As min. 58.4, is to min. 77.2: so is T. 45d. to T. 52d. 54m. the Course from the South towards the West, that is, SW. three Quarters W. almost. And again, As S. 52d. 54m. is to min. 77.2; so is S. 90d. to 96.8 Minutes, the Distance from the first Place of Departure.

D. M.

Latitude failed from - - - - - 40 : 00 North.

The Diff. of Latitude min. 58.4 or - 00 : 58 Southerly.

Subtract, gives the Lat. the Ship is in 39 : 02 North.

Therefore the middle Latitude is - - 39 : 31

Subtracted from - - - - - 90 : 00

Gives Complement of the middle Lat. 50 : 29

4. As S. 50d. 29m. is to m. 77.2; so is S. 90d. to 100.1m. the Difference of Longitude.

D. M.

The Longitude failed from is - - - 05 : 14 West

The Difference of Long. 100m. or - 01 : 40 West

Added gives the Long. the Ship is in 06 : 54 West

*Example 2.* A Ship in 41d. 30m. North Latitude, and 10d. 20m. East Longitude, fails these several Courses; and Distances, viz. S.E. by S. 52 Minutes, then S.S.W. 63 min.



63 Minutes, E. by N. 47 Minutes, N. by E. half E. 35 Minutes, NNW. a quarter W. 47 Min. WNW. 73 Min. I demand the Course and Distance from the first Place of Departure; also the Latitude and Longitude the Ship is in?

1. For the doing of which, observe the Work following.

	M.	Points.	M.
1	52	{ 3 }	{ 28.9 E.
		{ 5 }	{ 43.2 S.
2	63	{ 2 }	{ 24.1 W.
		{ 6 }	{ 58.2 S.
3	47	{ 7 }	{ 46.1 E.
} Course; as S. 8 Pts. is to { ; } fois S.		{ 1 }	{ 9.2 N.
4	35	{ 1 $\frac{1}{2}$ }	{ 10.2 E.
		{ 6 $\frac{1}{2}$ }	{ 33.5 N.
5	47	{ 2 $\frac{1}{4}$ }	{ 20.1 W.
		{ 5 $\frac{3}{4}$ }	{ 42.5 N.
6	73	{ 6 }	{ 67.4 W.
		{ 2 }	{ 27.9 N.

2. Then to collect the several Northings, Southings, Eastings, and Westings into one; and here you see in the Table following; whereby you will have the Difference of Latitude and Departure from the Meridian.

Courses.		Diff.	Lat.	Departure	
	Dist	North	South	East	West
1. S. E. by S.	52		43.2	28.9	
2. S. S. W.	63		58.2		24.1
3. East by North	47	9.2		46.1	
4. N. by E. $\frac{1}{2}$ E.	35	33.5		10.2	
5. N. N. W. $\frac{1}{4}$ W.	47	42.5			20.1
6. W. N. W.	73	27.9			67.4
		113.1	101.4	85.2	111.6
		101.4			85.2
Difference Latitude		11.7	Departure		26.4

3. Now



3. Now having the Difference of Latitude and Departure from the Meridian know, the Course and Distance is thus found.

As 11.7 Minutes, is to 26.4 Minutes ; so is T. 45d. to T. 66d. 06m. The Course North Westerly, or W.N.W. because the North and West Columns are the greatest.

Here observe the Course is more than 45 Degrees from the Meridian, because the Departure is more than the Difference of Latitude ; according to the Note in the 6th Case of Plane-Sailing in Page 214. Then for the Distance, say,

As S. 66d. 06m. is to 26.4 minutes ; so is 90 deg. to minutes 28.88 : The Distance from the first Place of departing.

	D.	M.	
Latitude failed from - - - - -	41	30	North
The Difference of Latitude m. 11.7 or -	00	12	North
<hr/>			
Added, gives the Lat. the Ship is in - -	41	42	North
<hr/>			
And the middle Latitude is - - - - -	41	36	
Subtracted from - - - - -	90	00	
<hr/>			
Gives Comp. of middle Latitude - - - -	48	24	

4. Then to find the Difference of Longitude, say ;  
As S. 48d. 24m. is to 26.4m. so is S. 90d. to 35.31 min.  
the Difference of Longitude.

	D.	M.	
The Longitude failed from is - - - - -	10	20	East
The Difference of Longitude 35.31 min or -	00	35	West
<hr/>			
Subtract, gives the Logit. the Ship is in -	09	45	East

*Secondly*



*Secondly, The Use of Gunter's-Scale in Mercator's Sailing.*

C A S E I.

*The Latitude and Longitude of two Places given ; to find the Course and Distance between them.*

*Example.* I demand the Course and Distance from the Lizard to Barbadoes? Latitudes and Longitudes of those Places being supposed as follows :

	d.	m.		d.	m.
Lizard			North		
Barbadoes			North		
} Lat. {	49	57	} Longit. {	5	14 W.
	12	58		58	50 W.

The Diff. of Lat. 36 59 South, Diff. Long. 53 36 W.  
                                 60                                60

Minutes 2219

Minutes 3216

To answer this Question, the Proportions are these,

1. As the Meridional Difference of Latitude, is to the Difference of Longitude ; so is Radius, to the Tangent of the Course.

2. As the Sine Complement of the Course, is to the Difference of Latitude ; so is Radius, to the Distance of the two Places.

The Meridional Difference of Latitude is thus found :

Extend the Compasses on the Meridional Line, from one Latitude to the other ; that Extent measured on the Equinoctial Line (the next Line adjoining to the Meridional Line marked EP.) gives the Meridional Difference of Latitude.

Thus, the Extent from Latitude 49d. 57m. to Latitude 12d. 58m. on the first, being measured on the latter, is deg.  $44\frac{7}{8}$  or 44d. 45m. or 2685 minutes, the Meridional Difference of Latitude : Then say ;

As



As 2658 M. is to 3216 M. } So is T. 45d. to T. 50d. 09m.  
 Or, As 44d.  $\frac{75}{60}$  is to 53d.  $\frac{16}{60}$  }  
 the Course from the South Westward, or S. W. 5 degrees  
 9 minutes Westerly. And again :

As S. 39d. 51m. is to 2219m. so is S. 90d. to 3463m.  
 Or, as S. 39d. 51m. is to 36d.  $\frac{983}{80}$ , so is Sine 90d. to  
 57d.  $\frac{72}{60}$  or 57d. 43m. equal to 3463 Minutes.

## C A S E II.

*Both Latitudes and Course given; to find the Distance and  
 Difference of Longitude.*

The Proportions are these :

1. **A**S the Sine Complement of the Course, is to the Difference of Latitude, &c. as before in the Second Case of Plane Sailing, to find the Distance and Departure from the Meridian, in Page 210.

2. As the Sine Complement of the middle Latitude, is to the Departure from the Meridian; so is Radius to the Difference of Longitude.

Or thus ; as the Sine Complement of the Course, is to the Meridional Difference of Latitude, so is the Sine of the Course, to the Difference of Longitude.

*Example.* Admit from the *Lizard* in 49 deg. 57 min. North Latitude, and Longitude 5d. 14m. West, we made (when Leeway, Variation, &c. allowed for) our Course to be South 39 deg. Westerly; and then by Observation was in 44d. 58m. North Latitude. I demand her Distance Run, and what Longitude she is in ?

Lat.



Latitude sailed from - - - - - 49d. 57m. North.  
 Latitude by Observation - - - - - 44d. 58m. North.

Subtract, is the Diff. of Latitude 04d. 59m. Southerly.  
 60

Minutes 299

The Middle Latitude is - - - - - 47d. 27m.  
 Subtract from - - - - - 90d. 00m.

Compl. of the Middle Latitude 42d. 33m.

1. As S. 51d. is to 299m. so is S.  $\left\{ \begin{smallmatrix} 90 \\ 39 \end{smallmatrix} \right\}$  d. to  $\left\{ \begin{smallmatrix} 385 \\ 242 \end{smallmatrix} \right\}$  Distance Depart.

2. As 42d. 33m. is to 242 Minutes; so is S. 90d. to 358 Minutes, the Difference of Longitude. Or thus, The Extent from 49d. 57m. on the Meridian Line, to 44d. 58m. measured on the Line of Equal Parts, is 7d.  $\frac{4}{5}$  or 7d. 24m. or 444 Minutes, for the Meridional Difference of Latitude: Then,

As 51d. is to 444 Minutes; so is S. 39d. to 358m. Or thus;

As 299 Minutes, is to 242 Minutes; so is 444 Minutes to 358 Minutes as before, which is the Difference of Longitude.

The Longitude sailed from - - - - - 05 : 14 West  
 The Difference of Longitude 358 min. or 05 : 58 West

Added, gives the Longitude the Ship is in 11 : 12 West

### C A S E III.

*Both Latitudes and Distance Run given; to find the Course and Difference of Longitude.*

To perform this, the Proportions are these;

1. **A**S the Distance sailed is to Radius; so is the Difference of Latitude to the Sine Complement of the Course, as in the Fourth Case of Plane Sailing, in Page 211, by which Case also you may find the Departure from the Meridian, or Meridian Distance.

2. As



2. As the Sine Complement of the middle Latitude, is to the Departure; so is the Radius, to the Difference of Longitude. Or thus;

As the Difference of Latitude, is to the Departure from the Meridian; so is the Meridional Difference of Latitude to the Difference of Longitude.

*Example.* A Ship in 46d. South Latitude, and 1d. 15m. West Longitude, fails 100 Leagues North Eastward, and then by Observation is in Lat. 42d. South: I demand her Course, Departure from the Meridian, and the Longitude she is in?

Latitude fail'd from is - - - 46d. South.

Latitude by Observation is - - 42d. South.

Subtract, gives the Diff. Lat. 4d. or 80 Leagues.

The middle Latitude is - - - 44d. whose Comp. is 46d.

1. As 100 Leag. is to S. 90d. so is 80 Leagues, to S. 53 deg. 15 min. the Complement of the Course; so that the Course is 36 deg. 45 min. North Eastward, or N.E. by N. a quarter E. And then again.

As S. 90d. is to 100 Leag. so is S. 36d. 45m. to 60 Leag. the Departure from the Meridian.

2. As S. 46 deg. is to 60 Leag. so is S. 90d. to 83 Leag. the Difference of Longitude, or thus: The Extent from 46d. to 42d. on the Meridional Line, makes 5d.  $\frac{15}{60}$  or 110 Leagues on the equal Part, which is the Meridional Diff. of Latitude. And then it's.

As 80leag. is to 60leag. so is 110leag. to 83leag. } diff. long.  
Or, as 4d. is to 3d. so is 5d.  $\frac{15}{60}$  to 4d.  $\frac{105}{60}$  }  
Longitude failed from is - - - - - 1d. : 15m. West.  
The Difference of Longitude 83leag. or 4d. : 09m. East.

Subtract gives the Longitude Ship is in 2d. : 54m. East.



C A S E IV.

Both Latitude and Departure from the Meridian given ;  
to find the Course, Distance Run, and Differ. Long.

1. **T**HE Course and Distance Run, is found by the  
Sixth Case of Plane-Sailing, in Page 213.

2. The Difference of Longitude is found as in the second, third, or fourth Case in *Mercator*.

*Example.* A Ship in 33 Degrees North Latitude, and  
178 Degrees West Longitude, sails South Westward until  
she has departed from the Meridian 58 Leagues, and then  
she is in Latitude 28d. 36m. North : I demand her Course,  
Distance Run, and what Longitude she is in ?

	d.	m.
Latitude sailed from	- - - - -	33 : 00 North
Latitude the Ship is in	- - - - -	28 : 36 North

The Difference of Latitude is - 04 : 24 or 88 Leagues

The middle Latitude is - - - - - 30 : 48 Comp. 59° 12'

1. As 88 Leagues, is to 58 Leagues ; so is T. 45 deg.  
to T. 33d. 20m. which is the Course South Westerly, or  
S.W. by S.

2. As S. 33d. 20m. is to 58 Leagues ; so is S. 90d. to  
105 Leagues, the Distance sailed.

3. The Meridional Difference of Latitude 5 deg.  $\frac{15}{60}$  or  
5 deg. 9 min. or 103 Leagues, is found as before directed.

4. As { S. 59d. 12m. } is to 58 leagues { S. 90 deg. }  
88 Leagues { 103 leag } to  
67 Leagues, the Difference of Longitude.

5. Longitude sailed from - - - - - 178 : 00 West  
The Difference of Longitude 67 leag. or 03 : 21 West

Added, the Sum is	- - - - -	181 : 21
Which subtract from	- - - - -	360 : 00

Remainder is the Longitude the Ship is in 178 : 39 East  
C A S E







C A S E VI.

*Sailing in a Parallel, to find the Difference of Longitude.*

To do this, the Proportion is thus ;

**A**S the Sine Complement of the (Parallel or) Latitude, is to the Distance sailed East or West ;

So is Radius to the Difference of Longitude.

*Example.* If a Ship sails West 390 Minutes, in the Latitude of 50d. 10m. and departs from 2d. 45m. East Longitude. I demand what Longitude the Ship is now in ?

As S. 39d. 50m. is to 390 min. so is 90d. to 610 min. the difference of Longitude.

	d.	m.	
Longitude sailed from, is - - - - -	2	45	East
The Difference of Longit. 610 min. or -	10	10	West
Subtract, gives the Longitude the Ship is in	7	25	West

C A S E VII.

*The Diff. of Longitude (of two Places in one Parallel or Latitude) given, to find their Distance in that Parallel.*

**T**HE Proportion is thus : As Radius is to the Difference of Longitude ; so is the Sine Complement of the Latitude, to the Distance in that Parallel.

*Example 1.* Suppose Cape St. Vincent in Portugal, and Cape Henry in Virginia, both in 37 deg. North Latitude, and their Longitude as here-under, what is their Distance in their Parallel.

	d.	m.	
Cape St. Vincent } Longitude	09	06	West
Cape Henry } Longitude	75	24	West
Subtract gives the Diff. Longit.	66	18	or 3987 minutes
Latitude of both Places is nearly - - -	37	deg.	North
Subtract from - - - - -	90		
Remains Complement of the Latitude - -	53	degrees	

P

2. As



2. As S. 90 degrees, is to S. 53 degrees; so is 66  $\frac{3}{8}$  equal to 66d. 18m. to 52d.  $\frac{95}{8}$  or 52d. 57m. or 3177m. the Distance required. Or thus:

As S. 90 degrees, is to S. 53 degrees; so is 3978 Minutes, to 3177m. the Distance in the Parallel as above.

*Example 2.* Suppose two Ships under the Equinoctial, 100 Leagues asunder, and each sails North till both come into Latitude 60 Degrees. How far are they now asunder? *Answer,* 50 Leagues for it's thus;

As S. 90 degrees; is to S. 30 degrees; so is 100 Leagues, to 50 Leagues, the Distance required.

### C A S E VIII.

*To find how many Minutes or Miles make a Degree of Longitude in any Parallel of Latitude.*

#### *The R U L E.*

**A**S Radius, is to the Sine Complement of the Latitude; so is 60 min. (a Degree on the Equinoctial,) to the Minutes making a Degree of Longitude in the Parallel desired.

*Example.* In the Latitude of 50 deg. I demand how many Minutes of Easting and Westing make a Degree of Longitude? *Answer,* 38  $\frac{1}{2}$  Minutes. For it's thus.

As S. 90 deg. is to S. 40 deg. so is 60 min. to min. 38.5 or 38 and a half, to make one degree of Longitude in Latitude 50 Degrees.

This may be done by the Plane-Scale, thus:

Take the given Latitude from the Chords, and measure it on the Line M.L. (which is Miles of Longitude) sheweth your desire: As here, take 50 deg. from the Chords, and measure it on the Scale M.L. it sheweth 38 min. and a half, as before.



VI. The Use of Gunter's-Scale in Astronomy.

PROBLEM I. The Sun's Place in the Ecliptic, and his greatest Declination given, to find his Right Ascension and present Declination.

To perform this, these are the Proportions;

1. AS Radius is to the Sine Complement of the Sun's greatest Declination; so is the Tangent of the Longitude (from the nearest Equinoctial Point,) to the Tangent of his Right Ascension, from the said Point.

The Names and Characters of the 12 Signs,

♈ Aries	} North Signs	♎ Libra	} South Signs
♉ Taurus		♏ Scorpio	
♊ Gemini		♐ Sagittarius	
♋ Cancer		♑ Capricornus	
♌ Leo		♒ Aquarius	
♍ Virgo		♓ Pisces	

Note 1. The Sun's greatest Declination is 23 degrees 29 min.

Note 2. The beginning of Aries and Libra are the two Equinoctial Points.

Note 3. This Proportion (above) finds the Sun's Right Ascension only when he is in the first Quarter of the Ecliptic: that is, ♈, ♉, and ♊: But when he is in the second Quarter, ♋, ♌, and ♍, subtract it from 180 deg. and when in ♎, ♏, and ♐, add to it 180 deg. And in the last Quarter, ♑, ♒, and ♓, subtract what's found by this Operation) from 360 deg. so will you have the Sun's Right Ascension from ♈ (for any Place in the Ecliptic) desired.

2. As Radius, is to the Sine of the Sun's Longitude (from the nearest Equinoctial Point) so is the Sine of the Sun's greatest Declination, to the Sine of his present Declination.



*Note,* The Sun being in  $\gamma$ ,  $\delta$ ,  $\pi$ ,  $\phi$ ,  $\lambda$ , and  $\mu$ , his Declination is North: But  $\alpha$ ,  $m$ ,  $\zeta$ ,  $\nu$ ,  $\omega$ , and  $\chi$ , it's South.

*Example.*

*When the Sun's Place in the Ecliptic is in  $\delta$  24d. 15m. What is his Right Ascension and Declination?*

The Sun being in  $\delta$ , 24 Degrees 15 Minutes, his Longitude from the nearest Equinoctial Point (being now the beginning of  $\gamma$ ) is 54 degrees 15 minutes. And the Complement of his greatest Declination is always 66 Degrees 31 Minutes. Then it follows:

1. As S. 90 degrees, is to S. 66 degrees 31 minutes; so is Tangent 54 degrees 15 minutes, to Tangent 51 Degrees 52 Minutes, the Sun's Right Ascension (from the beginning of  $\gamma$ ) required.

*By the Gunter with Compasses.*

The Extent from Sine 90 Degrees, to Sine 66 Degrees 31 Minutes, will reach from Tangent 54 Degrees 15 Minutes, to Tangent 51 Degrees 52 Minutes, the Sun's Right Ascension.

*By the sliding Gunter.*

1. Let the middle Piece be so put in, that Sines may slide against Sines, and Tangents against Tangents.

2. Then bring 90 Degrees in Sines (on the out-side Piece) against 66 deg. 31 min. in Sines (on the middle Piece) then against 54 deg. 15 min. in Tangents (on the middle Piece) is 51 deg. 52 min. in Tangents (on the out-side Piece) the Right Ascension, as above.

This Proportion being to be wrought on Sines and Tangents, jointly, I thought it necessary to express the manner of its Operation on both Sorts of *Gunters*, that the Learner might see how it agrees with the General Rule given at the Beginning of this Discourse of the *Gunter*, in Page 177, and 178; but shall wave it in the rest, and only write the Proportion in Words and in Figures, according to the particular Example, as follows, for the Sun's Declination.

2. As



2. As S. 90 Degrees, is to S. 54 deg. 15 min. so is S. 23 deg. 29 min. to S. 18 deg. 52 min. the Sun's Declination North, increasfing.

P R O B L E M II.

*The Latitude of a Place, and the Sun's Declination given; the find his Amplitude, and Ascensional Difference; and consequently his Rising and Setting; and the Length of the Day and Night.*

To perform this Problem, the Proportions are these;

1. **A**S the Sine Complement of the Latitude, is to Radius; so is the Sine of the Sun's Declination to the Sine of his Amplitude.

*Note,* The Amplitude and Declination are always of one kind; that is, both North or both South.

2. As the Tangent Complement of the Latitude, is to the Tangent of the Sun's Declination; so is Radius, to the Sine of his Ascensional Difference.

*Note 1.* The Ascensional Difference (being reduced into Time, by allowing 15 Degrees for one Hour, and then) added to, and subtracted from 6 Hourrs, the one is Sun-rising, the other Sun-setting.

*Note 2.* If the Latitude and Declination are both North or both South; the Sun riseth before and sets after Six of the Clock; but if one be North, and the other South, the contrary.

*Note 3.* If the Sun's rising and setting be doubled severally, the former is the Length of the Night, and the latter the Length of the Day.

*Note 4.* By this Problem were the Tables of Amplitudes, and Semidiurnal Arches, &c. in this Book calculated.

*Example.* Latitude 51 deg. 32 min. North, and the Sun's Declination 23 deg. 29 min. North: I demand his Amplitude, and Ascensional Difference: Also his Rising, Setting and Length of the Day and Night.

P 3

d. m.



*Answ.* Sun's Amplitude  $\begin{matrix} \text{d.} & \text{m.} \\ 39 & : & 50 \end{matrix}$ , Ascen. Diff.  $\begin{matrix} \text{d.} & \text{m.} \\ 33 & : & 10 \end{matrix}$

Sun-setting } is Hours }  $\begin{matrix} 8 & : & 13 \\ 3 & : & 47 \end{matrix}$ , Leng. of Day  $16 : 26$   
 Sun-rising } Leng. of Night  $7 : 34$

For it's thus;

1. As S.  $38^{\circ} 28'$  is to S.  $90^{\circ}$ , so is S.  $23^{\circ}$   $29'$  to  $39^{\circ} 50'$  the Amplitude North, because the Declination is North, that is, the Sun riseth East  $39^{\circ} 50'$  Northerly, and setteth West  $39^{\circ} 50'$  Northerly.

2. As T.  $38^{\circ} 28'$  is to T.  $23^{\circ} 29'$ , so is S.  $90^{\circ}$  to S.  $33^{\circ} 10'$  the Ascensional Difference; which being reduced into Time, is 2 hours 13 minutes; and added to 6 hours, is 8 hours 13 minutes for Sun-setting; which doubled, is 16 degrees 26 minutes, the Length of the Day.

Again, 2 hours 13 minutes subtracted from 6 hours, is 3 hours 47 minutes for Sun-rising; which doubled is 7 hours 34 minutes, the Length of the Night.

### P R O B L E M III.

*Latitude of a Place, and the Sun's Declination given; to find his Altitude and Azimuth at Six of the Clock.*

*To solve this, say;*

1. **A** S Radius, is to the Sine of the Latitude; so is the Sine of the Sun's Declination, to the Sine of his Altitude at Six of the Clock.

2. As Radius, is to the Sine Complement of the Latitude; so is the Tangent of the Sun's Declination, to the Tangent of his Azimuth (from the East or West) at Six of the Clock.

*Note,* The Azimuth is from the East, at Six in the Morning; and from the West at Six in the Afternoon; Northerly, in North Latitude; but Southerly, in South Latitude.

*Example.* In  $51^{\circ} 32'$  North Latitude, the Sun's Declination being  $23^{\circ} 29'$  North. What is his Altitude, and Azimuth at Six of the Clock.

*Answ.*



*Answer,* His Altitude is 18d. 11m. and his Azimuth is East 15d. 7m. Northerly, or 74d. 53m. North Easterly, or Westerly. For it's thus:

1. As 90d. is to S. 51d. 32m. so is S. 23d. 29m. to S. 18d. 11m. the Altitude of Six of the Clock.

2. As S. 90d. is to S. 38d. 28m. so is T. 23d. 29m. to T. 15d. 07m. the Azimuth at Six; that is 74d. 53m. North Easterly at Six in the Morning, but North Westerly in the Afternoon.

# P R O B L E M IV.

*Latitude of a Place, and the Sun's Declination given; to find his Altitude, and Hour of the Day, when he is East or West.*

To perform this, the Proportions are these:

1. **A**s the Sine of the Latitude, is to Radius; so is the Sine of the Sun's Declination, to the Sine of his Altitude, when East or West.

2. As the Tangent of the Latitude, is to the Tangent of the Sun's Declination; so is Radius, to the Sine of the Hour from Six of the Clock, when he is East or West.

*Note 1.* The Sun is East after Six in the Morning, but West before Six in the Afternoon.

*Note 2.* The Hour found (by the last Proportion) being reduced into Time (by allowing 15 deg. to an Hour) and added to, or subtracted from 6, gives the Hour of the Day, when the Sun is East or West.

*Example.* In 51d. 32m. North Latitude, the Sun's Declination being 23d. 29m. North; what is his Altitude? and what Time of the Day is it, when he is East or West?

*Answer,* His Altitude is 30d. 35m. and the Hour of the Day is { 7h. 21m. Morning, when East.  
4h. 39m. Afternoon when West.

For it's thus?

1. As S. 51d. 32m. is to S. 90d. so is S. 23d. 29m. to S. 30d. 35m. the Sun's Altitude, when either East or West.

P 4

2. As



2. As T. 51d. 32m. is to T. 23d. 29m. so is S. 90d. to S. 20d. 11m. the Hour from Six, which makes 1 Hour 21 Minutes, added to 6, is 7 h. 21 m. and subtracted from 6, is 4 h. 39 m. the former is the Time when the Sun is East in the Morning; the latter the Time when he is West in the Afternoon.

### P R O B L E M V.

*The Sun in the Equator or Equinoctial, (that is, when he hath no Declination) the Latitude of a Place, and the Sun's Altitude given; to find his Azimuth, and the Hour of the Day.*

This Problem is thus performed.

1. **A**S the Tangent Complement of the Latitude, is to the Tangent of the Sun's Altitude; so is Radius to the Sine Complement of his Azimuth from the South in North Latitude; but from the North in South Latitude; Easterly, in the Forenoon; and Westerly in the Afternoon.

2. As the Sine Complement of the Latitude, is to Radius; so is the Sine of the Sun's Altitude, to the Sine Complement of the Hour from Noon.

*Example.* In 51d. 32d. North Latitude, the Sun having no Declination, and his Alt. being 21d. 50m. in the Forenoon; I demand his Azimuth and the Hour of the Day?

*Answer.* His Azimuth is South 59d. 45m. Easterly, that is, the Sun is upon the SE. by E. a quarter E. Point of the Compass, and the Hour of the Day is Hours 8.27 Minutes Morning. For it's thus:

1. As T. 38d. 28m. is to T. 21d. 50m. so is S. 90d. to S. 30d. 15m. whose Complement is 59d. 45m. is the Sun's Azimuth required.

2. As S. 38 deg. 28 min. is to S. 90 deg. so is S. 21 deg. 50 min. to S. 36 deg. 50 min. whose Complement is 53 deg. 10 min, or 3 Hours 33 Minutes, which subtracted



tracted from 12, gives 8 Hours 27 Minutes, or 27 min. after 8 of the Clock in the Morning, the Time of the Day required.

P R O B L E M VI.

*Latitude of a Place, Sun's Declination, and his Altitude given; to find his Azimuth, and the Hour of the Day.*

The Peformance of this, is as follows;

1. **T**AKE the Complement of the Latitude, the Complement of the Sun's Altitude, and the Sun's Distance from the Pole, (which is his Declination) added to 90 deg. when the Latitude and Declination is one North, the other South; but both being North, or South, it's the Complement of the Declination, and add them together into one Sum.

2. From half that Sum subtract (to find the Sun's Azimuth) the Sun's Distance from the Pole; but (to find the Hour) subtract the Complement of his Altitude; and note the Remainder.

3. To find the Azimuth, you have these two Proportions following.

*First*, As Radius, is to the Sine Complement of the Latitude; so is the Sine Complement of the Altitude, to a fourth Sine. Then again,

*Secondly*, As that fourth Sine, is to the Sine of the half Sum; so is the Sine of the Remainder, to a fifth Sine; against which, on the Line of Versed Sines, is the Sun's Azimuth from the North in North Latitude; but from the South in South Latitude.

4. To find the Hour, these are the two Proportions which follow.

*First*, As Radius, is to the Sine Complement of the Latitude; so is the Sine of the Sun's Distance from the Pole, to a fourth Sine.

*Example*



*Secondly.* As that fourth Sine, is to the Sine of the half Sum; so is the Sine of the Remainder, to a fifth Sine; against which, on the Versed Sine, is the Hour of the Day from Noon.

*Example.* In 51 deg. 30 min. North Latitude, the Sun's Declination being 15 deg. 10 min. North, and his Altitude observed to be 11 deg. 30 min. I demand his Azimuth, and Hour of the Day?

	d. m.		d. m.	d. m.
	90.00		90.00	90.00
Latitude	51.50	North Declinat.	15.10	Nor. Alt. 11.30
Comp. Lat.	38.30	Sun's dist. fro Pole	74.50	Com. Alt 78.30
Comp. Alt.	78.30	Comp. Latitude	38.30	
Sun's Dist.	74.50	Comp. Altitude	78.30	
Sum is	191.50	Sum is - - -	191.50	
half Sum is	95.55	The half Sum is	95.55	
Remainder	21.05	Remainder is - -	17.25	

Then to find the Azimuth, it's thus :

1. As S. 90d. is to S. 38d. 30m. so is Sine 78d. 30m. to Sine 37d. 20m. the fourth Sine.

2. As S. 37d. 20m. is to S. 95d. 55m. so is Sine 21d. 05m. to S. 36d. against which, on Versed Sines, is 80d. the Sun's Azimuth from the North Easterly, if in the Forenoon; but North Westerly in the Afternoon.

And to find the Hour of the Day, it's thus :

1. As Sine 90d. is to Sine 38d. 30m. so is Sine 74d. 50m. to Sine 37d. the fourth Sine.

2. As Sine 37d. is to Sine 95d. 55m. so is Sine 17d. 25m. to Sine 29d. 40m. against which, on the Versed Sines, is 90d. 30m. or 6 Hours 2 Minutes, which is the Hour from Noon; that is, 58 Minutes after Five of the Clock in the Morning; or two Minutes after Six in the Afternoon.



T H E

DESCRIPTION and U S E of the

S E C T O R.

1. **T**HIS useful Instrument may be of any Length, but it's commonly made one Foot six Inches, or two Feet long, to open with a Joint in the Middle like a Carpenter's Rule; one Inch and a half (or more) in Breadth, and of any Thickness at Pleasure, according to the Matter it's made of; which may be either Box-wood, Ivory, Brass, or Silver.
2. There are two sorts of Sectors, known by the Names of *Gunter's* and *Forster's* Sector; and are sometimes both put on one Instrument; that is, *Gunter's* Sector on one Side of it; and *Foster's* on the other.
3. The Lines on *Gunter's* Sector are these, *Line of Lines*, (marked on the End with L) *Line of Sines*, (marked S) *Superficies*, (marked Sup.) *Solids* (marked Sol.) *Line of Metals*, *Line of Equated Bodies*, *Line of Inscribed Bodies*, &c.
4. The Lines on *Forster's* Sector are these Five, viz. *Line of Lines*, or *Equal Parts*, *Chords*, *Sines*, *Tangents*, and *Secants*, each marked at the End with it's Name, or first Letter of its Name.
5. All *Sector-Lines* or *Scales*, meet at the Center of the Head (where the Joints is) on the Left-hand, and from thence are figured towards the Right, each being twice repeated; that is, one on each Leg or Side of the *Sector* answering one another.
6. The *Sector* is useful in Projection, to reduce, or to make a Scheme to any possible Magnitude: Also in Proportion, to work any stated Canon or Proportion in *Arithmetic*, *Geometry*, *Trigonometry*, *Navigation*, *Astronomy*, &c. of which I will give a brief Account, yet so as the Learner may be informed how to employ them further.



I. *The Use of the Sector Lines for Projection.*

**I**N Projection it's often required to enlarge or diminish the Scale, that the Draught designed may be of its desired Magnitude; in doing of which are used Lateral and Parallel Distances, or Extents of the Compasses; and to avoid a needless saying over the same Things, take once for all what's meant by a Lateral, and a Parallel Distance, or Extent of the Compasses.

1. A *Lateral Distance* (in any Line or Scale, is the Extent or Distance taken in the same Line, on the same Side or Leg of the Sector from the beginning thereof, to any Number therein desired.

As for Example; the Lateral Sine of 30 Degrees is the Distance of 30 from the beginning of the Line of Sines; and so it is in the Line of Equal Parts, Chords, Tangents, Secants, &c.

2. A *Parallel Distance* (in any Line, or Scale on the Sector) is the Extent or Distance, taken across from any Number in any Line on one Leg of the Sector, to the like Number in the like Line on the other Leg of the Sector.

Or, the nearest Distance from any Number on one Leg (taken across) to the like Number on the like Line on the other Leg of the Sector.

As for Example: The Parallel of Sine of 30 Degrees is (supposing the Sector opened to any Angle) the Distance from 30 in the Line of Sines on one Leg of the Sector, to 30 in the Line of Sines on the other Leg.

Or, the nearest Distance from 30 in the Line of Sines on one Leg, to 30 in the Line of Sines (that is to say, the Line issuing from the Center of the (Joint or Head) on the other Leg, is the Parallel Sine of 30 Degrees. In like manner it is done in any other Line or Scale.

This being understood, the inlarging or diminishing any of the Sines; or the finding a Chord, Sine Tangent, or Secant to any proposed Radius will not be difficult,



difficult ; and for the Learner's further Information, take this General Rule.

I. *To find the Chord, Sine, Tangents, and Secants, &c. to any Radius (greater or lesser) proposed.*

The General Rule is thus ;

1. Take the proposed Radius in the Compasses, and make it a Parallel on the Sector in the Radius of any one Line, that is, open the Sector till the proposed Radius (in the Compasses, be a Parallel Chord of 60 Degrees in the Line of Chords ; or a Parallel Sine of 90 Degrees in the Line of Sines ; or a Parallel Tangent of 45 Degrees in the Line of Tangents ; or a Parallel Secant of 0 Degrees in the Line of Secants ; for the Chord of 60, Sine of 90, Tangent of 45, and Secant of 0 Degrees are equal, and each equal to Radius.

2. The Sector being kept at that opened Distance or Angle, any Parallel Distance in any Line, will be a Lateral Distance on a like Line to the proposed Radius ; that is, a Parallel Chord of 10, 20, 30, &c. is the Chord of 10, 20, 30, &c. to the proposed Radius ; also a Parallel Sine, Tangent and Secant of 20, 30, 40, &c. is the Sine, Tangent and Secant of 20, 30, 40, &c. to the foresaid Radius.

II. *The Use of the Sector in working Proportions.*

Supposing the Learner understands how to take a Lateral Distance on the Line of Lines (otherwise called Equal Parts) on the Chords, Sines, &c. And to apply them parallel in any Line on the Sector ; the working of any Proportion is thus :

*A General Rule to work by the Sector.*

1. Take the second Term Lateral (that is, from the beginning of the Line to the proposed second Term) and opening the Sector, apply that Extent Parallel (that is,



is across it) in the first Term: then stay the Sector at this Parallel Extent.

2. Take the Parallel Distance of the third Term, and measure it Laterally, gives the fourth Term sought, or required.

Or briefer thus: As the Lateral second Term, is to the Parallel first Term; so is the Parallel third Term to the Lateral fourth Term.

This one Rule is sufficient for any Proportion whatever, and will appear so by a few Examples.

PROB. I. *To multiply by the Line of Lines on the Sector.*

The Proportion is ;

AS 1, is to the Multiplier; so is the Multiplicand, to the Product.

*Example.* What's the Product of 8 multiplied by 4?

The Analogy, or Proportion, is this ;

As 1, is to 4 ; so is 8, to the Product 32 : thus found by the Sector, and general Rule aforesaid.

1. On the Line of Lines, (that is the Line of Equal Parts) take the second Term 4 Lateral ; that is, from the Center of the Joint, and the beginning of the Line, to 4 in the same Line.

2. Open the Sector till you fit the (aforesaid Lateral) Distance in the Compasses in the Parallel of 1 and 1, or 10 and 10 ; that is, set it over from 10 to 10 at the End of the same Line, and now counted for 1 and 1, the first Term: keep the Sector just at that Angle or Opening.

3. The Parallel Distance of the Third Term 8 ; that is from 8 to 8 taken across from one Leg to the other, in the said Line of Lines, and measured Lateral (that is from the beginning of the Line towards the End) reacheth to 32, the fourth Term, which is the product of 8 multiplied by 4. Or shorter, thus ;

As



As the second Term 4 (Laterally taken) is to the first Term 10 (Parallel set) so is the third Term (taken Parallel) 8, to the fourth Term (measured Laterally) which is 32, the Product as before. Or thus: As the Lateral 8, is to the Parallel 10, counted for 1; so is the Parallel 4, to Lateral 32, as above.

P R O B L E M II.

*To divide by the Line of Lines on the Sector.*

The Analogy, or Proportion is thus;

**A**S the Divisor is to 1; so is the Dividend, to the Quotient. Or thus:

As the Divisor is to the Dividend; so is 1, to the Quotient.

*Example 1.* How many Square Yards are in 36 Square Feet? *Answer*, 4 Square Yards. For it's thus:

As 9, is to 1; so is 36, to the Quotient 4: thus to be wrought by the Sector: As Lateral 1, is to Parallel 9; so is Parallel 36, to Lateral 4, the Yards required.

P R O B L E M III.

*To work the Rule of Three by the Line of Lines on the Sector: or unto three Numbers given, to find a fourth in Geometric Proportion.*

The Analogy is:

**A**S the first Term, is to the second Term; so is the third Term, to the fourth Term required.

*Example 1.* If the Diameter of a Circle be 14 Inches; What is the Circumference? *Answer* 44 Inches. For the Proportion is thus:

As 7 is to 22; so is the Diameter 14, to 44, the Circumference required; by the Sector thus wrought; As Lateral



teral 22, is to Parallel 7; so is Parallel 14, to Lateral 44, the Circumference of a Circle whose Diameter is 14.

*Example 2.* If a Plank or Board be 15 Inches broad, and 20 Feet long; how many Feet are in it? *Answer* 25 Feet: For the Proportion is this:

As 12, is to 15 the Breadth: so is 20 the Length, to 25 Feet, the Content of the Board: And by the Sector thus to be wrought; as Lateral 15, to Parallel 12, so is Parallel 20, to Lateral 25 Feet, the Content of the Plank.

PROB. IV. *The Use of the Sector in Plane-Sailing.*

*Example 1.* A Ship in 42d. 10m. North Latitude, sails NE. by N. 104 Leagues; I demand the Latitude she is in, and her Departure from the Meridian?

The Proportions are these;

1. As Radius, to the Distance sailed; so is the Sine of the Course, to the Departure from the Meridian. That is, by the Sector, thus: As Lateral 104 Leagues (on the Line of Lines) is to Parallel Sine of 90 Degrees; so is Parallel Sine of 33 Degrees, 45 Minutes (the Degrees of the Course from the Meridian) to Lateral 58 Leagues (on the Line of Lines) the Departure from the Meridian.

*Note,* If 104 Leagues taken Lateral be troublesome, to fit Parallel in Sine of 90 Degrees; then take it's half, or quarter Lateral; and the Answer will be accordingly its half or quarter: As here, if you take 52, the half of 104 Leagues; the Answer will be 29, whose double is 58 for the Departure from the Meridian, as before.

2. As Radius is to the Distance sail'd, so is Sine Complement of the Course, to the Difference of Latitude.

*By the Sector thus:*

As Lateral 104 Leagues, is to Parallel Sine of 90 deg. so is Parallel Sine of 56 deg. 15 min. to Lateral 87 Leagues, the Difference of Latitude; by which you may find the Latitude the Ship is in, as before in the Use of the Gunter, in Pages 208 and 209. *Example*



Example 2. *A Ship sails South Easterly, 'till her Difference of Latitude be 275 Minutes, and the Departure from the Meridian be 412 Minutes; I demand her Course and Distance sailed?*

The Proportions are these;

1. As the Difference of Latitude, is to the Departure; so is Radius, to the Tangent of the Course. That is,

*By the Sector thus;*

As Lateral 412 Minutes, is to Parallel 275 Minutes; so is Parallel Tangent of 45d. (that being Radius now) to Lateral Tangent of 56d. 15m. the Course from the Meridian, which makes SE. by E.

2. As the Sine of the Course, is to the Departure; so is Radius, to the Distance sailed.

*By the Sector thus;*

As Lateral 412 min. is to Parallel Sine 56 deg. 15 min. so is Parallel Sine of 90 deg. (that now being Radius) to Lateral 495 min. the Distance sailed.

After this manner may any Proportion be wrought by the Sector, which I leave for the Learner's Exercise.

---

*The Use of the following TABLES of Latitudes and Longitudes.*

**L**atitude and Longitude are two primary Affections of the Earth: By the Help of these two the Geographer endeavours to represent the Parts of the Earth, that they may keep symmetry and proportion with the Whole.

Latitude is an Arch of the Meridian, comprehended between the Equator and a Parallel; But Longitude is an Arch of the Equator, intercepted between the Meridian of London, in the following Tables, and the Meridian of any other Place.

For the exact settling of Latitude, we have many absolute Helps; but to determine the Longitude of a Meridian



and more especially the Longitude of a Place at Sea, in that which hath, and still wearie the greatest Masters of *Geography*.

I have endeavoured to settle the Longitude with as much exactness as possibly I could: For I not only calculated according to the Latitude and Meridian Distance of each Place from the Meridian of *London*; which Meridian Distance I obtained from the exactest *Geographic Charts* extant, but I consulted with the Reckonings of skilful Mariners, and when I found any Difference, I adjusted it both according to Art and Reason.

As for Instance: I had from able Mariners, upon their long Experience, the Meridian Distance from *Barbadoes* to the *Lizard*: According to which I have settled the Longitude of all the eminent Places in the *West-Indies*.

And for the settling of the Longitudes of Places in the *East-Indies*, I consulted Observations of Eclipses, both Ancient and Modern; as in Page 161 of *Harmonicon Cæleste*, the Difference of Meridians between *Goa* and *London*, is 5h. 48m. and *Malacca* and *London*, 6h. 49m. My Table hath the former of these 5h. 58m. and the latter 6h. 45m. the Difference between my Tables and the former of these Observations is 10m. and of the latter 4m. which Difference may be born withal.

“ If the Reader considers the Time, being 1664, with  
 “ the great Labour and Pains (to my Knowledge, being  
 “ then his Servant, the Author bestowed, and expended  
 “ in compiling this Work, the Performance may justly  
 “ be look'd upon as then the best of its Kind.

“ But since that Time there hath been better Helps,  
 “ new Discoveries made, and new Places found out; the  
 “ Corrector, at the Request of the Bookseller, and out of  
 “ Respect to the deceased Author, but most of all for the  
 “ Public Good, hath made such Amendments herein as  
 “ were possible, by comparing of the best Observations,  
 “ Tables, Charts, Maps, and Sea-Journals, he was able to  
 “ procure; so that it may be concluded, that these Tables are  
 “ the



“ the truest, or come (in general) nearest the Truth  
“ of any extant in our Language; not that they are so  
“ exact in every particular Place, as to need no Amend-  
“ ment in Time, but with respect to the present Help  
“ they are so.

“ And now I could wish that either Authority would  
“ order, or that all Persons concerned in constructing  
“ Tables, Charts, and Maps, would mutually unite in a  
“ fixed Meridian where to begin Longitude.

“ For altho' Longitude may be begun at any Meri-  
“ dian, yet the Convenience of its beginning at one  
“ Meridian, in all our *English* Navigation Books and  
“ Charts, would render the Study and Practice of Na-  
“ vigation much more pleasant and easy than now it is.  
“ Such various beginnings and countings of Longitudes,  
“ occasion some to stumble, others to mistake, and some  
“ to condemn all to be false, by not considering the  
“ several Meridians made use of, which such a wished-  
“ for Union would prevent.

“ But this is not likely to be in my Time, who am  
“ so near the Grave; yet should it be set on Foot, while  
“ I am on this Side the other World, my best Perform-  
“ ances should not be wanting to promote it, and should  
“ count all my spare Hours from necessary Preparations  
“ for my last End, well spent in such a Useful and Public  
“ Good.”

*Note* 1. I do begin the Longitude in my Tables) at the  
Meridian of *London*, and increasing it on both Sides the  
said Meridian; that is to say, both Eastward and West-  
ward, and End in 180 deg. the opposite Meridian.

2. Therefore (according to this Account) all Places on  
the East-side of the Meridian of *London* lie in East Lon-  
gitude; and on the contrary, all on the West-side of it lie  
in West Longitude.

3. If a Ship be in East Longitude, sailing to the East-  
ward the Longitude increaseth; but sailing to the West-  
ward the Longitude decreaseth.

Q 2

4. And



4. And on the contrary, if a Ship be in West Longitude sailing to the Westward, the Longitude increaseth, and sailing to the Eastward it decreaseth.

5. Take Notice, that at all Places in East Longitude, the Sun cometh on their Meridians before he cometh on the Meridian of *London*. As thus : if a Place lie in 15 deg. East Longitude, the Sun cometh one Hour sooner to the Meridian there, than he doth to the Meridian of *London*: If in 30 deg. East Longitude, then two Hours sooner ; If 45 deg. three Hours sooner ; if 60 deg. four Hours sooner ; if 75 deg. five Hours sooner ; if 90 deg. six Hours sooner ; if 105 deg. seven Hours sooner ; and so you may reckon for any other Longitude. But on the contrary, All those Places that lie in West Longitude, the Sun or Star cometh on their Meridians after they are past the Meridian of *London*.

*To find the Difference of Longitude between any two Places.*

**I**F both Places be in East Longitude, or both in West Longitude, subtract the lesser Longitude out of the greater, the Remainder is the Difference of Longitude.

If one Place be in East Longitude, and the other in West Longitude, add both together, and their Sum is the Difference of Longitude, if it exceed not 180 deg. but when the Sum doth exceed 180 deg. subtract it from 360 deg. the Remainder is the Difference of Longitude required.

*Note,* That the Longitudes of Places, tabulated in Mr. COLSON's *Mariner's New Calendar*, heretofore estimated from the Meridian of the *Lizard*, are in the last Edition of that Book, reduced to the Meridian of *London*.

A T A B L E



*A TABLE containing the chief Harbours, Headlands and Islands in the World, shewing their Latitude and Longitude: Beginning the said Longitude at the Meridian of London.*

*The Sea-Coasts of Greenland.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
<b>H</b> Acluits Headland	79	55	11	00
Fair Foreland	79	20	10	52
Cape Cold the North End of } Charles Isle	79	00	10	00
Black Point, South End of it	78	00	10	30
Dear Sound	79	15	12	40
Foul Sound	77	28	12	50
Bell Sound	77	15	12	40
Horn Sound	76	45	13	36
Point Lookout	76	25	15	36
Helies Sound	78	55	21	50
Cape Barcan, or Barcam	78	15	22	11
Cape Blanco	77	45	22	30
Ducks Cove } Negro Point } Edges Island	77	35	23	10
Hope Island	76	55	23	30
Cherry Island, or Bear Island	76	18	23	45
Ice Point, or Cape Desire	74	30	18	08
Admiralties Island	77	40	69	10
Langeness	75	05	55	50
Cross Point	74	20	53	36
Fretum Burrough	72	00	53	12
Colgoyen Isle	70	00	61	20
Cape Candemose	69	00	45	00
Cape Barfo	69	05	42	35
	66	30	38	00

North Latitude

East Longitude



The Coasts from *Archangel* to the *Naze* of *Norway*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Archangel	64	30	40	30
Cape Grace, or Cape Bona Fortuna	66	00	36	30
Cape Gallant, or Sweetnose	68	10	34	45
Kilduyn Island	69	30	31	20
River Kola Entrance	69	10	31	05
Fishers Island	70	00	26	38
North Cape	71	23	23	02
Tromsund Island	70	25	15	30
Island Sanien, South West Point	69	35	13	00
Loeford, West Point	68	15	09	40
Werro, or Weroy Island	67	30	07	30
Dronten, or Dronthem	63	40	10	15
Ranfdel	63	15	06	30
North Point	62	20	05	26
Katts Nefs, or Scuts Nefs South Point	61	45	03	36
Hearle Island the South End	60	40	03	38
North Bergen	60	10	05	40
Bommel Island, North Point	59	25	05	40
Jedder	58	05	06	10
Naze of Norway	57	45	07	24
Masterland	57	53	11	45

North Latitude.

East Longitude.

Sea



Sea-Coasts in the Sound.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Maerden	58	19	18	57
Caperwick	59	20	10	10
Ansloo or Christiana	59	40	10	00
Gottenberg Gat	57	50	12	15
Cape Kol	56	30	12	13
Elfenburg	56	10	12	30
Valsterborn	55	28	13	00
Christianople	56	10	16	00
Calmer	56	40	16	35
Oeland the { South End	56	17	15	30
{ North End	57	20	17	00
Landfort	58	40	18	20
Stockholm	59	20	19	30
Aboo	60	40	21	10
Raseborg	60	28	22	35
Borgo	60	40	26	00
Pelting Sound	60	32	26	50
Wyburg	60	52	29	16
Petersburgh	60	00	30	25
Narva	59	27	28	25
Revel	59	27	24	51
Nargin Island	59	35	24	30
Sybrannefs in Dagoo, or Dagerort	59	00	23	00
Arensburg in Oesel Island	58	20	23	32
Parnaw	58	30	25	47
Runen Island	57	55	24	00
Ryga	57	04	25	15
Domenefs	57	30	24	00

North Latitude

East Longitude



## Sea Coasts in the Sound.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Der Winda	57	15	22	06
Der Memel	55	48	21	36
Coningsburgh	54	43	21	35
Dantzick	54	22	18	36
Heel	54	40	19	08
Gotland, the North End	58	00	20	15
Faro Sound	58	03	18	50
Gotland Wisbuy	57	30	18	30
Gotland, the South End	57	00	17	45
Bornholm	55	15	14	45
Camin, or Hamin	54	10	15	00
Jasmond, or Rugen	54	40	14	00
Rostock	54	37	18	40
Straelfund	54	25	13	16
Wismar	54	10	12	00
Lubeck	54	06	09	55
Copenhagen	55	41	12	50
Elfenore	56	22	12	42
Uraniburg	55	54	12	58
Anout, or Anholt Island	56	50	11	06
Leson or Lesnow Island, or Jesou	57	05	10	30
The Scaw	57	30	10	20

North Latitude.

East Longitude.

The Sea Coasts of *Holland* and *Flanders*, from the  
*Scaw* to *Calais*.

Holy Land, or Helighland Isles	54	24	08	35
Hambrough	53	41	10	35
Bremen	53	30	09	00
Emden	53	05	07	35
Ameland Island, or Amoyland	53	30	06	20
Scheling	53	27	05	58
The Fly	53	16	05	30

North Latitude

East Longitude.



The Sea-Coasts of *Holland* and *Flanders*, from the *Scarw* to *Calais*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
The Texel	53	15	05	10
Amsterdam	52	23	05	04
Rotterdam	51	55	04	30
Antwerp	51	10	04	20
The Brill	52	00	04	00
Middleburgh in Zealand	51	37	03	58
Sluys	51	14	03	43
Ostend	51	14	03	01
Dunkirk	51	02	02	27

North Latitude

East Longitude

The Sea-Coasts about the Island of *Iceland*.

Grims Hole, or Geuberman's Rocks	66	23	29	30
Gamar Isles, or Gille	65	48	26	54
Westmania Isles	63	30	22	54
Rook Point	64	00	26	24
Snow Hill	65	11	27	14
Fair Foreland	66	20	26	27
Rage Point, or Orgal Bay	66	00	25	25
Marza, or Largeness	66	08	24	00
Grimfa Isle	67	15	22	34
Lange Nefs	66	46	12	50
Bargarers Point	66	20	16	35
Silly, or Pappy Isle	64	50	12	10
Horn Bay	64	50	12	00
Merchants Foreland	63	25	17	05
Portland	64	02	21	05
Greens Island	66	50	24	40

North Latitude

West Longitude



The Sea-Coasts of *Scotland*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Sky Island North End	57	45	05	45
Island of Lewis, North End	58	20	07	00
Farro Head, or C. Wrath	58	34	05	10
Shetland South End	60	04	02	00
Fair Isle	59	30	02	20
Isles of Orkney	59	10	03	22
Cath Ness Point	58	40	02	36
Buchan Ness	57	45	01	18
Aberdeen	57	22	01	40
Dundee	56	28	02	40
Leith	56	00	02	56
Edenburgh	55	58	02	59
Berwick	55	48	01	45

North Latitude

West Longitude

The Sea Coasts of *England* from *Berwick* to the *Lizard*.

Newcastle	55	12	01	30
Sheiles, or Sheilds	55	02	01	23
Sunderland	54	55	01	20
Hartlepool	54	43	00	56
Whitby	54	26	00	50
Scarborough	54	20	00	40
Flamborough Head	54	08	00	11
Burlington	54	00	00	08
The Spurn	53	45	00	13
Hull	53	52	00	20
Grimesby	53	30	00	56
Boston	53	10	00	25
Lynn	52	55	00	32
Wells	53	10	01	00
Blackney	53	08	00	55
Cromer	53	10	01	05

North Latitude

West Longitude. E. Lon.



*The Sea Coasts of England, from Berwick to the Lizard.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Winterton	52	57	01	22
Yarmouth	52	42	01	38
Alborough	52	16	01	28
Orfordness	52	12	01	16
Ipswich	52	10	01	05
Harwich	52	05	01	18
Colchester	51	58	00	56
L O N D O N	51	31	00	00
Rochester	51	28	00	26
Maregate	51	27	01	14
The North Foreland	51	27	01	24
Sandwich	51	25	01	14
The Downs	51	23	01	25
The South Foreland	51	10	01	20
Ripraps, a Sand	51	53	01	26
Dover	51	06	01	18
Dungeness	50	57	00	51
Rye	51	02	00	45
Beachy	50	46	00	25
Shoram	50	55	00	17
Portsmouth	50	49	01	00
Isle of Wight, Newport	50	42	01	25
Pool	50	56	01	54
Weymouth	50	42	02	40
Portland	50	30	02	44
Chiddock	50	46	03	00
Lime	50	45	03	15
Topsham	50	38	03	28
The Berry	50	25	03	49
Torbay	50	32	03	39
Dartmouth	50	26	03	38
The Start Point	50	07	03	47

East Longitude.

West Longitude.

North Latitude



*The Sea-Coasts of England.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
The Eddyſtone	50	10	04	24
Plymouth	50	31	04	17
Ramhead	50	16	04	35
Foy	50	24	04	35
Falmouth	50	11	05	10
L I Z A R D	49	57	05	14

North Latitude

West Longitude

*Sea Coasts from the Lizard to Holy-Head.*

Lands End	50	06	06	00
Gulf	49	56	06	06
Scilly Islands, the middle	50	00	06	45
Seven Stones	50	10	06	40
Hartland Point	51	10	04	35
Londey Iſle	51	20	04	40
Mort Bay, or Mort Point	51	12	04	40
Bristol	51	33	04	35
Swandſey	51	40	04	25
Caldy Iſland	51	33	05	14
Milford	51	45	05	15
St. David's Head	51	00	05	22
Barſey, or Bardſey Iſle	52	44	05	00
Liverpoole	53	20	03	00
Westcheſter	53	37	04	20
Lancaſter	54	42	04	36
White Haven	54	17	03	30
Iſle of Man, Weſt End	53	45	05	00
Holy Head	53	24	04	50

North Latitude

West Longitude.



*The Coasts of Ireland.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Fair Foreland	55	05	06	30
London Derry	55	00	07	50
Island Torre	55	09	08	30
Isles of Arran	54	48	08	59
Stags of Broad Haven	54	07	10	06
Isles or Arian	54	55	09	50
Galway	53	07	09	40
Gall, or Doen's Head	52	40	09	30
Lupis's Head	52	24	10	15
Limrick	52	23	09	35
Blasques	52	00	11	56
Skillocks	51	30	11	55
Cow and Calf	51	22	10	36
Mizan, or Miffen Head	51	16	11	30
Old Head of Kinsale	51	35	08	58
Cape Clear	51	17	11	10
Kinsale	51	50	09	40
Cork	51	49	09	30
Waterford	52	09	08	40
Wexford	52	13	07	27
Dublin	53	12	06	56
Lumbay Island	53	24	07	30

North Latitude

West Longitude

*The Sea Coasts of France.*

Calais	50	58	01	54
Dieppe	49	56	01	09
St. Vallery	50	10	00	56
Sain Head, Cape de Antifer	49	44	00	34
Rouen Mouth	49	34	00	30
Cape Barfleur	49	43	01	14 W
Cape de la Hogue	49	47	02	00 W

North Latitude.

East Longitude.



The Coast of *France*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Alderney	49	50	02	12
Caskets	49	50	02	20
Guernsey	49	33	02	40
Jersey	49	15	02	20
St. Maloes	48	39	01	57
Morlaix	48	33	03	49
Island de Bas	48	50	04	00
Ushant	48	30	05	02
Conquet	48	27	05	00
Brest	48	23	04	25
Camarita Bay	48	25	04	28
Seams	48	02	05	00
West Penmark	47	48	04	24
Bell Isle	47	18	03	16
Nantz	47	14	01	39
Heys Isle	46	24	02	14
Isle de Rey the middle	46	10	01	30
Isles of Oleron	45	56	01	00
Rochel	46	10	01	11
Bourdeaux City	44	50	00	38
St. Sebastian	43	24	01	27
Bilboa	43	29	02	58
Cape Pinas	43	56	06	00
Cape Ortegal	44	04	07	48
Cape Corunna, or Groin	43	28	09	20
Cape Finistere	43	12	09	40
Isles of Bajona	42	29	09	27
Oporto	41	10	09	25
Burlings	39	35	09	24
Rock of Lisbon	38	52	09	50
Lisbon	38	42	08	53
Cape St. Vincent	36	53	09	06
Cape St. Maria	36	58	08	30
Cadiz	36	33	06	01

North Latitude.

West Longitude.



The Coasts on the Main Continent within the *Straits*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Gibraltar	36	12	04	53 W
Malaga	36	48	03	50 W
Cape de Gat	36	40	01	40 W
Cape Paul	38	15	00	05 E
Alicant	38	35	00	15
Cape St. Martin	38	46	00	40
Barcelona	41	26	02	18
Marseilles	43	18	05	27
Toulon	43	07	06	02
Genoa	44	25	08	43
Leghorn	43	28	10	35
Civita Vechia	42	10	12	25
Rome	41	54	12	45
Naples	40	51	14	46
Cape Spartevento	37	55	16	55
Cape Colonne	38	56	18	05
Gallipoli	39	56	18	43
Cape St. Maria, or Lucia	39	45	19	00
Ancona	43	40	14	26
Venetia, or Venice	45	25	12	10
Zara	44	30	16	35
Ragusa	42	55	18	50
Cattaro	42	47	19	17
La Valona	40	45	20	05
Point Palerma	40	00	20	15
Lepanto	38	10	22	52
Cape Matapan, or Caliga	36	33	22	41
Cape St. Angelo, or Angulo	36	32	23	56
Athens	37	58	24	05

North Latitude

East Longitude



The Coasts on the Main Continent within the *Straits*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Cape Martelo South Point } of Negropont ————— }	38	07	25	03
Cape Colom, or Collonne —————	37	45	24	42
Salonica —————	40	41	23	13
Cape Monte Sancto —————	40	26	25	02
Gallipoli —————	40	33	27	20
Constantinople —————	40	59	28	56
Cape Barbador, or Baba —————	39	30	26	30
Smyrna —————	38	28	27	25
Cape Barbernola, or Blane —————	38	09	26	32
Ephesus —————	38	01	27	53
Antiochetta —————	36	30	32	46
Scanderoon, or Alexandretta —————	36	34	36	30
Antiocha —————	36	11	36	25
Aleppo —————	35	42	37	24
Tortosa —————	35	00	36	30
Tripoli —————	34	38	36	15
Joppa, or Jaffa —————	32	27	35	20
Jerusalem —————	31	51	35	22
Alexandria —————	31	10	30	19
Cape Rufato —————	32	48	21	25
Cape Mesurato —————	32	21	16	17
Tripoly —————	32	54	13	10
Sufa —————	35	53	10	34
Cape Bona —————	37	03	11	04
Tunis —————	36	50	10	17
Bona —————	36	52	08	19
Seven Capes —————	37	15	07	00
Gigeri —————	37	14	06	15
Cape Tidelles, or Dellys —————	37	15	04	18
Algier —————	36	50	03	16
Cape Tenes —————	36	45	01	50
Orain —————	36	02	00	26
Cape Tres Forcas —————	35	30	02	04 W
Ceuta —————	35	54	04	45 W
Tangier —————	35	42	05	22 W

North Latitude

East Longitude



Islands within the Straits.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Formentura	38	33	01	55
Ivica	38	50	01	40
Majorca	39	30	03	03
Minorca	39	51	04	52
C. Tolare, South } End of Sardinia {	38	46	09	12
C.S. Reparade N. }	41	10	09	50
Afinaria	41	03	09	08
Bonifacio, South } End of Corsica {	41	24	09	46
C. Corfo, North }	42	56	09	50
Caprai, or Captia	43	03	10	17
Lilboa, or Elba	42	45	11	00
Planosa	42	30	10	45
M. Christo	42	17	11	00
Palmarolla, or Palmeria	41	03	13	35
Ponfa	41	00	13	37
Iscia, or Eschia	40	54	14	30
Strombello	38	58	16	00
Volcanello	38	27	15	33
Fellicur	38	30	15	00
Allicur	38	28	14	42
Ustica	38	36	13	52
Trapano West End of	37	57	13	13
Palermo in	38	06	13	50
C. Passaro East End of	36	38	15	40
Messina in	38	07	16	20
Siracusa in	37	03	15	45
C. Molin in	37	42	15	56
Pantalasia	36	48	12	20
Limosa	35	56	13	11
Lampidosa	35	34	12	46
Malta	35	53	14	32
Ouvre Poel, a Rock	35	45	16	36
Grande, or I. Longo	44	25	16	18

North Latitude

East Longitude



Islands within the *Straits*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Poma	43	10	16	08
St. Andrea	43	12	16	26
Lissa	43	06	16	40
Agosta	42	58	17	20
Corzola	43	03	17	32
Melada	42	52	18	06
Corfu	39	42	20	06
Cephalonia	38	15	21	00
Zante	37	46	21	14
Sapiensa	36	40	21	45

North Latitude

East Longitude.

Islands in the *Archipelago*.

Taffo	40	40	25	17
Lemnos	39	59	25	37
Metyline	Cape Sygre		39	15
	P. Olivia		38	57
Siatto, or Schate	39	22	23	58
Scio, or Xio	38	22	26	12
Patmos	37	20	26	55
Tino	37	35	25	36
Zio, or Sea	37	37	24	50
Ferminia, Fermina, or Termie	37	24	24	58
Serfante, or Sifanto	36	58	25	20
Millo, Mila, or Melo	36	40	25	00
W. } end of Candia	Cape St. John		35	15
	Cape Solomon		35	00
Rhodes	North End		36	27
	South End Cape Tranquill		36	01
S. W. }	C. Bassa		34	57
East }	end of Cyprus		35	31
South }	C de Gatte		34	30

North Latitude.

East Longitude.



Sea Coast of *Barbary* and *Guiney*, from *Tangier* to Cape  
*Bona Esperance.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Cape Spartel	35	50	05	49
Salé	33	51	06	25
Cape Cantin	32	36	09	10
Cape de Geer	30	27	10	06
Cape de Non	28	15	11	04
Cape Bajadore	26	04	15	35
Cape Blanco	20	32	17	35
Cape de Verde	14	43	17	20
River of Gambia's Entrance	13	08	15	31
Cape Roxo	11	50	15	04
Cape de Monte, or Mount	06	23	12	00
River Sester, or Sestos	05	24	08	36
Cape de Palmas	04	13	06	45
River St. Andrea	05	05	04	15
Cape Three Points	04	28	01	50
Cape Corfe	04	55	02	00
River de Volta, or Accara	05	55	03	25
Cape Formosa	04	15	06	40
New Calabar Entrance	04	42	08	33
Old Calabar Entrance	04	10	09	45
River de Camarones	03	25	10	10
Land of Fernand Poo	02	40	10	30
Land de Prince, or Prince's	01	40	09	15
River de Anger, or Angra	00	50	10	01
Land St. Thomas	00	00	08	20
Land St. Matthew's	01	30	06	01 W
Land Ascension	07	40	14	05 W
Land Anabona	02	10	07	27 E
Cape Lopas	00	55	09	55 E
Cape Negro	16	08	12	31 E
Land St. Helena Nova	16	00	06	04 E
Land St. Helena	15	56	04	10 E
River Congo	05	40	15	25 E
Cape St. Thomas	24	10	14	43 E



Sea Coast of *Barbary* and *Guiney*, from *Tangier* to Cape  
*Bona Esperance*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Cape Secos, Sego, or Seca	29	00	15	56 E
Cape Bona Esperance	34	07	18	40 E
Cape Aguilhas, or Lagullas	34	54	21	20 E
Island Tristian de Acunha	37	05	13	50 W

The Sea Coast of *Barzille*.

Island St. Paul	01	20	25	30
Para River	02	50	42	47
Cape St. Roque	05	00	35	47
Rio Grande	05	20	35	57
Permanbucó	07	48	35	30
Cape St. Augustin	08	35	35	20
Island Ferdinandó Lorenha	03	50	31	10
River St. Francisco	10	50	37	50
Bay de Todos Sanctos	12	46	41	00
Port Segura	16	31	40	35
Cape de Abrolhos	18	15	41	07
Spirito Sancto	19	59	42	10
Cape St. Thomas	22	10	42	15
Cape Frio	23	00	42	20
Island St. Catherina	27	50	49	00
River Grande's Entrance	31	55	52	00
Cape St. Maria	34	30	56	40
River de la Plata, or Cape St. Antonio	35	40	57	36
Cape de St. Andreas	38	40	63	05
Bay Sinfunda, or Sinfendo	42	35	68	00
Point de los Leones	44	00	70	40
River Camerones	45	30	73	00
Cape Blanco	46	50	72	07
Pepy's Isle	47	20	66	40
Point of River St. Julian	48	40	74	34
Cape Virgin Mary of Magel. Straits	52	00	75	05
La Maire Straits	54	34	73	01



*The Sea Coasts of Brazille.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
C. Horn, the S. part of Terra del Fuego	57	30	79	55
Island dos Picos	22	30	25	15
Island de Martinvas	19	30	26	55
Island St. Maria de Agosta	19	40	29	10
Island Trinidada	20	30	30	00
Island Ascension	07	40	14	05

South Latitude  
West Longit.

*The Coasts on the Main Continent in the East-Indies.*

Bay de Allogoor Dallagoa	25	30	31	05
River St. Lucia	28	20	32	17
Cape St. Martin, or Maria	22	40	35	05
Cape Corientes	23	40	36	17
Mofambique	15	04	41	10
P. de Aguada, or Del Gada	10	17	40	10
Cape de Falso	09	00	39	20
Tongon	04	50	38	59
Mombafo	03	50	38	30
Molinde, or Melinde	02	58	39	35
River Lamos	01	20	40	13
Magadoxa	02	20	44	50
Cape de Bassas, or Boxos	04	06	47	38
Cape de Gardefoy	11	44	51	20
Aden	13	00	47	00
Mocha	14	10	44	50
Cape Matriaca	15	23	52	10
Defar	17	00	55	35
Cape Refulgat	22	41	59	45
Muscat	23	32	59	45
Bassora, or Bufero	29	45	49	20
Gumbaroon	27	20	56	40
Cape Glado	25	50	63	34

South Latitude  
East Longitude  
North Latitude



The Sea Coasts on the Main Continent in the *East-Indies*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
River de Sinda, or Cinde	24	45	67	35
Diu Head	21	02	69	50
Surat	21	10	72	25
Demam	20	06	73	30
Bombay Island	19	18	73	06
St. John's	19	55	73	20
Chaule, or Choale	18	31	73	37
Dabul	18	03	74	00
Rajapour Ifle	17	02	74	10
Goa	15	31	73	50
Carwar	14	47	75	00
Manqu Shore	12	53	75	25
Tellecherry	11	42	75	25
Callecut	11	16	75	30
Cannanou	10	22	75	35
Cochin	09	54	75	55
Anjanga	08	29	76	25
Cape Comarin	07	50	77	25
Colombo in Zeylone	07	07	79	30
Point de Galle, or Gallo on the same	06	10	80	10
Dundre Head on the same	06	02	80	45
Trinconomale	08	40	81	40
Great Bassas Shoals	06	23	81	45
Jetrapatam	09	50	80	10
Negrapatam	11	01	79	55
Trincumbar	11	15	79	50
Porta Nova	11	45	79	44
Pondicherry	11	54	80	18
Fort St. David, or Tregapatam	12	05	79	48
Conymere	12	35	80	05
Fort St. George, or Madraffapatam	13	11	80	32
Pullicat	13	30	80	22
Armegon	14	16	80	12
Petapoly	16	06	80	42
Due point, or Mecha	16	08	81	32
Masulapatam	16	22	81	10

North Latitude.

East Longitude.



The Sea-Coasts on the Main Continent in the *East-Indies*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Massipore	16	30	81	57
Visagapatam	17	43	83	57
Birmilapatam	17	51	84	09
Pondy	18	49	85	15
Jacarnaut Pagod	19	51	86	42
Arsepure	29	11	87	23
Point Palmiras	20	42	87	52
Balafore Road	21	16	87	48
Piply	21	25	87	57
Hughly	23	09	89	05
Dacca	23	57	90	55
Casimbazar	25	06	88	45
River Bengal	22	17	92	21
River Aracan	20	10	93	40
Pegu	18	35	96	20
Melacca	02	12	102	10
Formosa	02	05	101	30
Point Romania	01	16	103	15
Point Cui	12	10	99	02
Siam Entrance	14	18	100	55
Cambodia Entrance	10	28	105	00
Cape Anarilla, or Avarilla	13	25	108	03
Cochin, or Chinchin	14	05	107	56
Tonquin	20	50	105	40
Canton	23	14	113	06
Amoye Island	24	35	116	50
Hockfew	26	30	118	20
River Swadia	27	51	118	50
Liampo, Lingpo, or Ningpo	29	59	120	35
Island Chusan	30	00	120	35
Nanquin	33	07	120	01
Pekin	39	54	116	28

North Latitude

East Longitude

Islands in the *East-Indies*.

St. Paul	38	20	75	25
Romeras de Castelamas	28	45	67	17
St. Joan de Lisbon	25	24	53	30
Diegen Reys	19	50	19	61

S. Lat.

Long.



Islands in the *East-Indies*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
St. Brandon	16	38	64	30
Mauritius	20	10	52	55
Malha	11	15	60	30
C. St. Mary S.	25	47	46	10
D. D' Ambre N.		10	51	05
St. John de Nova	17	21	43	20
St. Christova	17	36	43	40
Mayetto	13	10	45	38
Joanna	12	10	45	03
Mohilla	12	05	44	23
Comero or Angazecha	11	40	43	50
Morfia, or Monfia	08	07	40	15
Zanzebar	06	48	39	57
Penda	05	20	39	35
Comero	10	30	44	39
Cosmeledo	10	14	51	17
Juan de Nova	09	30	52	40
Astore Isle	09	55	53	50
Agalega, or Gallega	09	47	54	31
Setta Hermanes	02	47	59	13
Quevelo, Quebello	03	53	52	36
Bassas de Banhas	05	05	48	46
Hermanos	03	32	54	45
Island Gratio	06	10	63	01
Padra Banhas	02	10	65	32
Bassas de Chages, or Island de Chagos	06	55	68	45
Three Germans	04	30	62	43
Cross Island	04	10	58	05
Sacatora, or Zacatora	12	21 N	54	05
Island Abdeleur	12	04 N	53	04
Cubello	08	10 N	71	45
Malique	09	00 N	72	58
Garipe, or Gripe	10	40 N	72	37

South Latitude

East Longitude



*Islands in the East-Indies.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Qualpena	10	00	73	30
Andomaon, or Antada	11	10	73	32
Ceylone South End, C. Gallo	06	08	81	15
Maldiviæ { South } Part	00	25	76	22
{ North }	07	14	73	04
Yas de Diego Reys	00	20	72	00
Manila	14	25	117	06
Aynian { N.W. } Point	19	30	107	00
{ N.E. }	19	55	109	55
Japan { S.E. } Point	35	30	140	30
{ S.W. }	35	00	128	30
Cocos	04	10	91	02
Andaman the middle	12	35	93	19
Borneo	04	50	110	55
Nicobar	07	11	93	40
North West End of Sumatra	05	22	94	50
Bencola	03	55 S	104	08
South East End of Sumatra	05	22 S	105	10
Jambe	01	19 S	102	55
Bantam	06	11 S	105	55
Batavia	06	16 S	106	46

North Latitude

East Longitude.

*The Southern Islands, or Cape de Verde Islands.*

St. Antonio	17	35	24	40
St. Vincent	17	15	24	25
St. Lucia, or Round Island	17	07	24	20
St. Nicholas	17	00	23	38
Ile de Sal	16	55	21	56
Bonavista	16	05	22	08
Mayo, or Island May	15	14	22	08
St. Jago	15	08	22	45
Fuego, or Fulgo	14	50	23	35
Brava's	14	28	23	54
St. Paul	01	20	25	30

North Latitude.

West Longitude.



## The Canary Islands.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Sancto Porto	32	58	15	54
Maderia West End	32	23	17	26
Salvagas	30	00	16	50
Palma	28	40	17	36
Ferro	27	54	17	45
Gomero	28	06	17	05
Pico Tenariff	28	23	16	28
Grand Canaria	27	52	15	10
Allegranfa	29	20	12	33
Lancerota	29	02	13	45
Forteventura South West End	28	05	12	36

North Latitude

West Longitude

## The Western Islands.

Corvo	39	54	30	55
Flores	39	32	30	54
Fyal	38	53	28	15
Pico	38	40	27	20
St. George	38	52	26	03
Tercera	38	57	25	34
Gratiosa	39	16	27	01
Whale Fish	39	37	25	11
Vajo, or Vegia	38	43	23	48
St. Michael	38	06	23	36
Formigas, or Hormigas	37	40	22	47
St. Maria	36	59	23	38

North Latitude

West Longitude

The Sea Coasts of the North Part of *America*, *Hudson's Bay* and *Newfoundland*.

Cape Farewell	59	45	46	45
Cape Elizabeth	62	03	66	50
Island Resolution	61	50	65	04
Queen Ann's Foreland	63	48	74	45
Salvages Island	62	40	70	17
Salisbury Island	63	45	77	15
Mill's Isle	64	26	80	18
Nottingham Isle	63	30	79	53

North Latitude

West Longitude



*The Sea-Coasts of the North Part of America, Hudson's-Bay and Newfoundland.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Shark Point —————	64	30	82	55
Cape Southampton —————	61	55	86	48
Sir Thomas Roe's Welcome —————	64	15	92	04
Cape Churchill —————	59	00	95	20
Port Nelson, or York Fort —————	57	10	93	58
New Severn —————	56	00	88	20
Cape Heneretta Maria —————	55	07	84	30
Viner's Isle —————	53	05	84	03
Albany Fort —————	52	26	84	50
Moose River's Mouth —————	51	18	83	13
Point Comfort —————	51	24	81	11
Frenchman's River —————	51	20	80	14
Rupert's River —————	51	30	79	26
Charlton's Island —————	52	08	81	20
Danby's Island —————	52	15	80	56
Shepherd's Island —————	51	45	80	48
Solomon's Temple Island —————	53	05	81	00
Weston's Isle —————	52	58	82	48
Cubbs Isle —————	54	10	82	40
Bear's Island —————	54	25	83	45
Baker's Dozen's Isles —————	57	56	81	25
Sleeper's Isles —————	60	10	81	30
Mansfield Isle, the middle —————	61	42	80	30
Cape Jones —————	54	55	78	58
Cape Walsingham —————	62	35	77	55
Cape Charles —————	62	10	75	35
Button's Isles —————	60	25	66	27
Bell Island —————	52	07	55	35
Grey's Islands —————	50	35	53	25
Cape St. John —————	50	25	52	48
Pengwin Island —————	50	00	52	50
Cape Bonavista —————	49	15	52	12

North Latitude

West Longitude



The Sea-Coasts of *Hudson's-Bay*, *Newfoundland*, and  
*New-England*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Trinity Bay Entrance	48	52	52	20
Barcaleau Island	48	40	51	56
Conception Bay Entrance	48	20	52	08
Cape St. Francis	48	09	51	46
Cape Race	46	40	51	52
Bay of Bulls	47	50	51	29
St. John's Harbour	48	00	51	39
Cape St. Maria	47	10	53	23
Placentia Bay	47	45	53	58
Cape St. Laurens	47	30	54	23
Island St. Paul	47	10	58	18
Cape Roye	48	00	57	40
Virgin Rocks	46	06	51	07
French Factory	50	10	61	10
Bay of Brest	52	10	56	57
Tadoussack	49	00	67	05
Quebeck	46	55	69	48
Anti Costi Island, the middle	49	40	60	45
Cape St. Charles, or Charles Straits	52	10	55	00
Cape Britain	46	00	58	30
Cape Sable	43	50	64	58
Point, or Port Royal	44	45	65	40
Penobscut River	44	40	67	10
North Yarmouth	44	14	67	58
Pascataway Entrance	43	26	70	10
Cape Ann Island	42	46	69	45
Cape Codd	42	12	68	55
Boston Entrance	42	30	69	23
Plymouth	42	02	68	50
South of St. George's Bank	41	45	67	15
South End of Nantuket Shoals	39	50	68	23
Nantucket Island	41	15	68	48
Martha's Vineyard	41	14	69	09

North Latitude

West Longitude



Sea Coasts on the Main Continent in the *West-Indies.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Elizabeth's Island —————	41	35	69	13
Block Island —————	41	15	69	58
Montock Point —————	41	18	70	20
Fisher's Island —————	41	20	70	40
New York —————	40	58	73	53
Sandy Hook —————	40	25	73	54
Cape James, or Henlopen —————	38	50	74	56
Long Island, the middle —————	40	50	72	45
Cape May —————	39	06	73	39
Cape Charles —————	37	16	74	16
Cape Henry —————	37	00	75	24
Cape Hatteras —————	35	15	74	20
Cape Feare —————	33	58	76	54
Cape Roman, or Cattit —————	33	27	77	50
Ashly River, or Charles Town —————	33	05	78	46
Port Royal —————	32	00	79	43
Bay of St. Augustine —————	30	10	80	43
Cape Florida —————	24	57	80	30
Laphillapina or Apalachia —————	29	47	84	44
River Spiritus Sanctus, or Mischissippi } River's Mouth —————	28	54	96	50
Tompeck —————	22	20	100	15
Liva, or Vera Cruz —————	19	12	97	48
Sierra, or Cape de Martin —————	19	10	95	45
Triste, or Triest Island —————	18	10	91	20
Campecha —————	19	30	92	10
Cape Condesedo —————	20	40	89	40
Cape Catocha —————	21	10	86	10
Salamancha —————	16	50	89	10
Cape Honduras —————	16	25	84	45
Cape Camaron —————	16	10	83	30

North Latitude.

West Longitude.



The Coasts on the Main Continent in the *West-Indies*.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Entrance of Nicaragua	11	25	84	15
Porto Bello	09	33	79	45
Darien, or Scotch Settlement	08	30	78	45
Cartagena	10	28	75	21
Cape Conquistaco, or Coquibaco	12	40	70	42
Island Curaçoa, or Quicafao	12	10	68	15
Island Margaritta	11	20	63	20
Island Trindada	10	15	60	17
Mouth of Oronoque River	08	15	59	25
Cape Three Points	10	30	62	10
Cape Nassau	08	05	57	55
N. Cape, the middle of Caopory Island	02	05	49	56
Suranam	06	25	56	50
Cape Orange	04	25	51	25
Mouth Amazonas River	00	00	49	56

Islands in the *West-Indies*.

Tobago West End	11	10	59	10
Barbadoes, at Bridge Town	12	58	58	50
Granado	11	57	60	20
Granadillos	12	20	59	55
Boquia	12	50	59	53
St. Vincent	13	12	60	12
St. Lucia	13	55	60	04
Martinica	14	43	60	54
Dominica	15	23	60	30
Marigallanta	15	58	60	20
Guardalupa	16	10	61	15
Dessada	16	20	60	10
Antegua	17	05	61	45
Barbuda	17	56	60	40
Monferat	16	45	62	15
Rodondo	16	55	61	15



*Islands in the West-Indies.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Nevis	17	05	62	32
St. Christopher's	17	17	62	40
Eustatia	17	25	62	20
Saba	17	35	62	40
St. Bartholomew	17	52	62	06
St. Martin's	18	06	62	10
Anguilla	18	17	62	13
Sambrero	18	35	62	30
Anegada	18	47	62	46
St. Cruize	17	52	63	30
Virgins	18	30	63	25
St. Thomas	18	30	63	22
St. John de Port Rico	18	30	65	37
Islands and Rocks of Aves	12	01	64	30
Tortuga, or Tortugas	11	10	63	54
Margaritta	11	20	63	20
Blanco	11	50	63	40
Testigos	11	35	62	41
D' Orchila	11	45	64	30
Bonairy, or Bonaire	12	12	66	28
Aruba	12	50	68	28
East End of Hispaniola	18	18	69	15
West End of the same	18	26	74	36
East End of Jamaica	18	00	75	50
Port Royal in Jamaica	17	40	76	32
West End of the same	18	08	79	00
East End of Cuba	20	15	73	55
Havanna	22	40	82	55
West End of Cuba	21	40	86	30
La Bermudas	32	25	63	40
Bahama Island	26	50	79	16
Abaco South End	26	00	73	46
Andrews, or Andross, or North End	25	10	78	40
Providence	25	00	77	20

North Latitude

West Longitude



Islands in the *West-Indies.*

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Harbour Island	25	37	76	47
Eleuthera South End, or Hathern	24	40	75	56
Cat Island, the middle	24	25	75	09
Watling's Island	24	03	74	35
Rum Key	23	45	74	50
Exuma	23	22	75	55
Crooked Island, North End	22	56	74	12
Long Island, South End	22	41	74	52
Atwood's Keys	23	10	73	35
Mayaguana	22	35	72	46
French Keys	22	40	73	40
Merapervouz	21	58	74	45
Hogsties	21	17	73	55
Hineago, West End	20	25	73	49
West Caicos	21	38	71	58
Turks Island	21	35	70	08
Abrolho Bank, the North End	21	35	69	06
Plate Rack	20	10	68	15
Mucares	21	30	76	35
Verd	21	17	76	16
Cajad Zal	23	10	79	24
Pinos	21	20	84	20
Great Camains	18	54	81	29
Little Camains	19	30	80	24
St. Andreo	12	23	80	17
Caimanuback	19	08	80	11
Pedro Shoals, North Side	17	10	77	56
St. Milan	17	10	81	28
Guayna	16	53	88	30
Cozumelli	19	30	89	05
Zuna Quita	17	01	89	48

North Latitude

West Longitude

F I N I S.





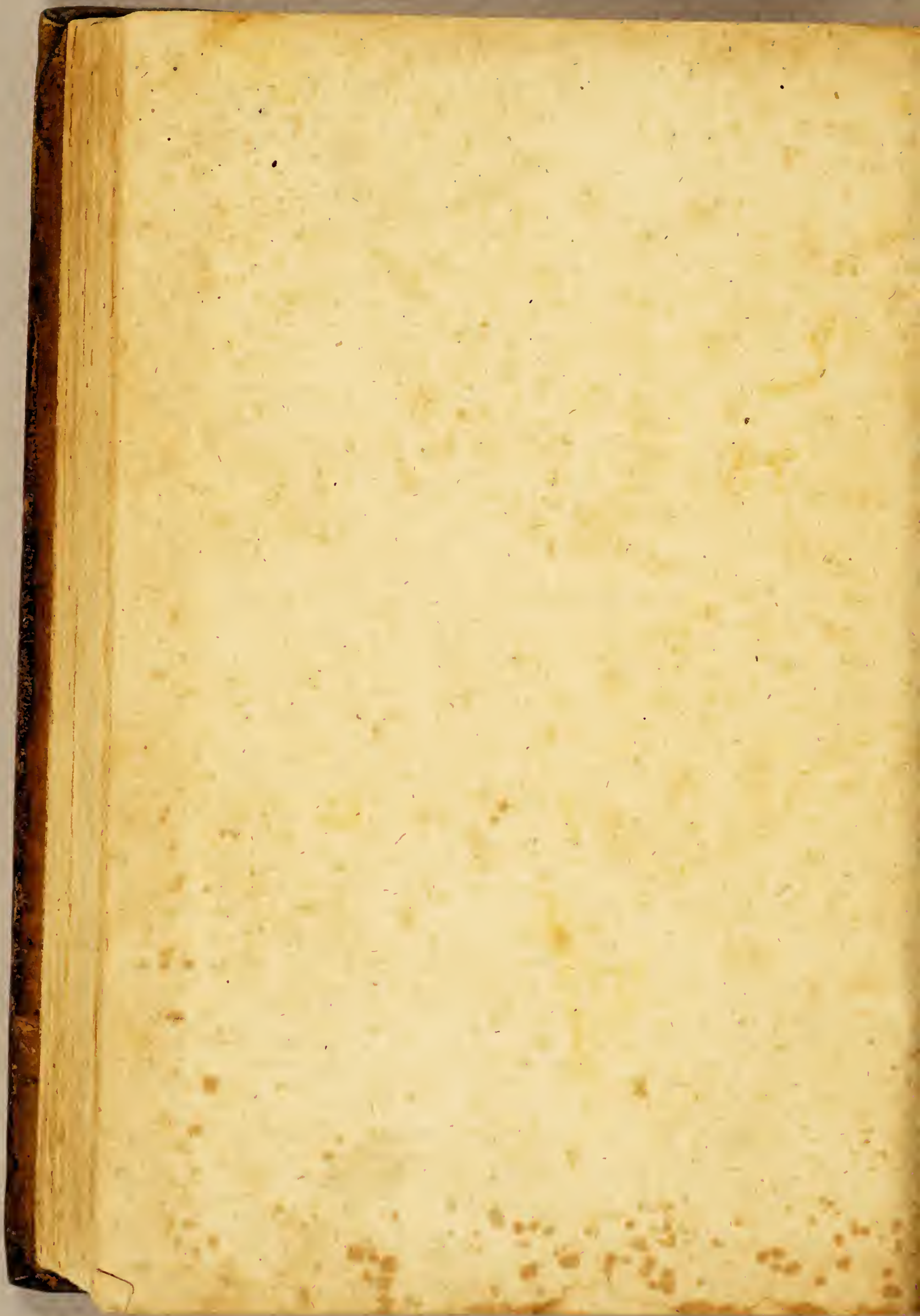














D 763

W 147m



